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Research and Development in Industry: 1990

Funds, 1990
Scientists & Engineers,
January 1991

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Surveys of Science Resources Series
National Science Foundation

Detailed Statistical Tables
NSF 94-304

Research and Development in Industry: 1990

Funds, 1990
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Principal Author: John R. Gawalt

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Contributors

Data collection, preparation, and tabulations were performed by Bureau of the Census, Department of Commerce for the National Science Foundation. The Project Officer for this report was John R. Gawalt.

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IV

General Notes

The Bureau of the Census (Census), U.S. Department of Commerce, has conducted the annual Survey of Industrial Research and Development for the National Science Foundation (NSF) since 1957. This report provides data on research and development (R&D) funding for the years 1980-90, and on R&D personnel for the period from January 1980 to January 1991.

All companies--foreign and domestic as well as those privately held--that perform R&D in the United States are included or represented in the survey data.

The industry R&D survey does not cover trade associations. Although their primary mission is to serve industry, these associations are established as nonprofit organizations, and it is estimated that their R&D expenditures are less than one percent of the industry R&D total.

It is an enterprise-based, rather than an establishment-based, survey. Therefore all R&D data for each enterprise are reported in the major Standard Industrial Classification (SIC) code of the firm. Data are aggregated in this manner for all tables in this report.

Data are based on probability samples selected about every five years. In intervening years, a subset of the last sample, called a panel, is used. The latest probability sample was selected and first used for survey year 1987.

Census staff conduct the survey under Title 13 of the U.S. Code, which prohibits publication or release of data that may reveal information about individual companies. Therefore, on some tables of this report, the symbol "(D)" is used as a footnote reference to indicate that data are being withheld to avoid possible disclosure of information about operations of individual companies.

Complete technical notes are contained in Section B of this report. Questions regarding the survey may be telephoned to John Gawalt, at (703) 306-1772, or mailed to him at the following address: National Science Foundation, Division of Science Resources Studies, 4201 Wilson Boulevard, Suite 965, Arlington, VA 22230.

Section A. Detailed Statistical Tables

Data on all tables are reported in terms of current dollars. For the convenience of the researcher, constant dollars are also presented in one summary trend table, Table A-1.

Because of rounding, details may not add to totals.

Percentages were calculated on the basis of thousands of dollars and may differ from those based on the rounded figures shown.

The publication or release of data that may reveal information about individual companies is prohibited by law. Therefore, on some tables, the symbol "(D)" is used to indicate that data are being withheld to avoid possible disclosure of information of individual companies. This occurs when a small number of companies accounts for a large percentage of the data in a particular cell.

Footnote reference "(S)" is used to indicate that the imputation rate--the percentage of the statistic estimated by Census staff--exceeds 50 percent. Interested users should consult Table B-3 for imputation rates for specific items.

Although publication of data may be withheld from certain cells, the data are always included in totals. In some instances, data withheld because of high imputation rates [footnote "(S)"] can be derived by subtraction from higher-level totals. In such cases, the user should be aware that the derived numbers are statistically unreliable. In no instance can data be derived that would disclose operations of individual companies [footnote "(D)"].

To obtain accurate historical data, use only the latest detailed statistical tables and not data published earlier. Data in trend tables are assembled from the most recently completed survey cycle. Data for prior years are reviewed for consistency with current-year responses and revised when necessary. For that reason, references to prior-year data should be restricted to those published in this document.

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[Dollars in millions]

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Year	Total R&D Current dollars	Total R&D Constant 1987 dollars	Federal Current dollars	Federal Constant 1987 dollars	Company 1/ Current dollars	Company 1/ Constant 1987 dollars
1953	$3,630	N/A	$1,430	N/A	$2,200	N/A
1954	4,070	N/A	1,750	N/A	2,320	N/A
1955	4,640	N/A	2,180	N/A	2,460	N/A
1956	6,605	N/A	3,328	N/A	3,277	N/A
1957	7,731	N/A	4,335	N/A	3,396	N/A
1958	8,389	N/A	4,759	N/A	3,630	N/A
1959	9,618	$37,585	5,635	$22,020	3,983	$15,565
1960	10,509	40,388	6,081	23,370	4,428	17,018
1961	10,908	41,554	6,240	23,771	4,668	17,783
1962	11,464	42,712	6,434	23,972	5,029	18,737
1963	12,630	46,451	7,270	26,738	5,360	19,713
1964	13,512	48,868	7,720	27,920	5,792	20,948
1965	14,185	49,930	7,740	27,244	6,445	22,686
1966	15,548	52,974	8,332	28,388	7,216	24,586
1967	16,385	54,130	8,365	27,635	8,020	26,495
1968	17,429	54,894	8,560	26,961	8,869	27,934
1969	18,308	54,897	8,451	25,340	9,857	29,556
1970	18,067	51,429	7,779	22,143	10,288	29,286
1971	18,320	49,527	7,666	20,725	10,654	28,802
1972	19,552	50,353	8,017	20,646	11,535	29,706
1973	21,249	51,488	8,145	19,736	13,104	31,752
1974	22,887	50,996	8,220	18,316	14,667	32,680
1975	24,187	49,171	8,605	17,493	15,582	31,677
1976	26,997	51,649	9,561	18,292	17,436	33,358
1977	29,825	53,383	10,485	18,767	19,340	34,616
1978	33,304	55,240	11,189	18,559	22,115	36,681
1979	38,226	58,316	12,518	19,097	25,708	39,219
1980	44,505	62,062	14,029	19,564	30,476	42,199
1981	51,810	65,699	16,382	20,774	35,428	44,925
1982	58,650	70,021	18,545	22,141	40,105	47,881
1983	65,268	74,883	20,680	23,726	44,588	51,156
1984	74,800	82,153	23,396	25,696	51,404	56,457
1985	84,239	89,265	27,196	28,818	57,043	60,446
1986	87,823	90,614	27,891	28.777	59,932	61,837
1987	92,155	92,155	30,752	30,752	61,403	61,403
1988	97,889	94,260	32,117	30,926	65,772	63,334
1989	101,854	93,944	31,292	28,862	70,562	65,082
1990	104,344	92,446	30,580	27,093	73,764	65,353
1991 (NSF est.)	106,750	91,161	30,400	25,961	76,350	65,201
1992 (NSF est.)	110,300	91,346	31,300	25,921	79,000	65,424

1/ Company funds include funds for industrial R&D work performed within company facilities from all sources except the Federal Government. The sources of funds may comprise those from outside organizations such as research institutions, universities and colleges, other nonprofit organizations, other companies, and state governments, as well as companies' own. Company-financed R&D not performed within the company is excluded.

N/A Not available

NOTE: The 1987 GDP implicit price deflator was used to convert current dollars to constant dollars.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-2. Selected data for R&D-performing companies, by industry: 1989-90

Page 1 of 1

Industry 1/	SIC code	Research and development funds						Domestic net sales		R&D scientists & engineers		Domestic employment	
		[Dollars in millions]						[Dollars in millions]		[In thousands]			
		Total		Federal		Company				January		March	
		1989	1990	1989	1990	1989	1990	1989	1990	1990	1991	1989	1990
Total		$101,854	$104,344	$31,292	$30,580	$70,562	$73,764	$2,544,772	$2,670,439	730.9	709.7	17,044	16,920
Food and kindred products	20	(D)	(D)	(D)	(D)	813	857	204,344	(S)	(S)	(S)	1,028	(S)
Tobacco products	21	471	519	0	0	471	519	54,103	60,187	2.3	2.9	236	233
Textile mill products	22	164	179	0	0	(S)	179	44,067	(S)	(S)	(S)	406	391
Apparel	23	(D)	(D)	(D)	(D)	50	(S)	(S)	(S)	(S)	(S)	(S)	(S)
Lumber and wood products, except furniture	24	42	49	0	0	42	49	10,208	(S)	(S)	(S)	(S)	(S)
Furniture and fixtures	25	130	131	0	0	130	131	14,903	15,392	(S)	(S)	176	177
Paper and allied products	26	686	736	0	0	686	736	96,887	91,328	(S)	(S)	558	555
Printing, publishing, and allied industries	27	(D)	(D)	(D)	(D)	180	214	26,519	28,616	(S)	(S)	232	290
Chemicals and allied products	28	11,466	12,565	83	67	11,383	12,498	213,619	219,073	78.9	79.9	1,090	1,085
Petroleum refining and extraction	13,29	2,066	2,099	(S)	(S)	2,050	2,083	214,844	245,549	10.2	10.0	406	403
Rubber products	30	(D)	(D)	(D)	(D)	678	732	40,991	41,763	(S)	(S)	451	(S)
Leather and leather products	31	9	10	0	0	(S)	(S)	1,574	1,640	(S)	(S)	(S)	(S)
Stone, clay, and glass products	32	(D)	(D)	(D)	(D)	863	893	37,631	38,211	8.6	8.3	300	297
Primary metals	33	749	(D)	34	(D)	715	774	83,461	77,879	(S)	(S)	456	420
Fabricated metal products	34	800	808	136	133	664	675	64,274	(S)	(S)	(S)	530	(S)
Machinery	35	14,635	14,700	1,157	896	13,478	13,804	169,181	164,683	112.3	107.0	1,397	1,359
Electrical equipment	36	16,929	17,397	5,288	5,629	11,641	11,768	236,806	239,773	138.0	141.0	2,005	1,901
Transportation	37	36,844	35,900	21,761	20,908	15,083	14,992	411,024	409,877	183.7	168.2	2,584	2,451
Professional and scientific instruments	38	5,743	6,163	113	99	5,630	6,064	76,798	79,538	(S)	(S)	593	585
Miscellaneous manufacturing industries	39	(D)	(D)	(D)	(D)	211	221	10,610	10,363	(S)	(S)	88	(S)
Communication services	48,part 737	(D)	313	(D)	0	249	313	59,390	64,263	4.0	2.7	357	359
Electric, gas, and sanitary services	49	234	248	21	20	213	228	162,723	182,234	1.6	2.6	553	558
Computer programming, data processing, other computer-related engineering, architectural, and surveying services	part 737,871	3,784	4,186	1,363	1,460	2,421	2,726	35,490	40,302	(S)	(S)	413	439
Hospitals and medical and dental laborarories	806-07	163	197	3	3	160	194	4,853	6,121	(S)	(S)	982	1015
Research, development, and testing services	873	1,405	1,432	550	494	855	938	18,569	22,793	12.1	12.2	73	74
Other nonmanufacturing industries	10-11,14-17,40-42,44-47,50-51,53-54,56,60,62-63,72-73,78,872,874	(D)	2,882	(D)	766	1,722	2,116	236,861	(S)	30.9	31.7	1,821	1,913

1/ Industries, industry groups, and product fields shown separately are classified according to the 1987 Standard Industrial Classification (SIC) manual codes.
(D) Data have been withheld to avoid disclosing operations of individual companies.
(S) Data have been withheld due to imputation of more than 50 percent.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-3. Total (company, Federal, and other) funds for industrial R&D performance, by industry and size of company: 1980-90

[Dollars in millions]

Page 1 of 2

Industry and size of company	SIC code	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Total		$44,505	$51,810	$58,650	$65,268	$74,800	$84,239	$87,823	$92,155	$97,889	$101,854	$104,344
Distribution by industry												
Food, kindred, and tobacco products 1/	20,21	620	(D)	(D)	(D)	(D)	(D)	(D)	1,206	(D)	(D)	(D)
Textiles and apparel	22,23	115	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Lumber, wood products, and furniture	24,25	148	161	159	152	143	147	144	137	(D)	172	180
Paper and allied products	26	495	(D)	566	(D)	(D)	(D)	(D)	(D)	(D)	686	736
Chemicals and allied products	28	4,636	5,625	6,604	7,185	7,927	8,540	8,843	9,635	10,772	11,466	12,565
Industrial chemicals	281-82,286	2,197	2,802	3,206	3,214	3,240	3,498	3,552	3,716	3,959	4,039	4,344
Drugs and medicines	283	1,777	(D)	(D)	(D)	(D)	(D)	3,658	(D)	4,746	(D)	(D)
Other chemicals	284-85,287-89	662	(D)	(D)	(D)	(D)	(D)	1,633	(D)	2,067	(D)	(D)
Petroleum refining and extraction	13,29	1,552	(D)	(D)	(D)	(D)	(D)	(D)	1,897	1,944	2,066	2,099
Rubber products	30	656	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Stone, clay, and glass products	32	406	(D)	(D)	(D)	(D)	(D)	950	995	(D)	(D)	(D)
Primary metals	33	728	878	987	1,085	(D)	(D)	(D)	730	663	749	(D)
Ferrous metals and products	331-32,3398-99	443	(D)	(D)	(D)	(D)	(D)	(D)	(D)	258	(D)	(D)
Nonferrous metals and products	333-36	285	(D)	(D)	(D)	336	416	458	(D)	405	(D)	(D)
Fabricated metal products	34	550	624	625	701	842	829	895	783	829	800	808
Machinery	35	5,901	6,818	8,078	9,027	10,504	12,216	(D)	(D)	(D)	14,635	14,700
Office, computing, and accounting machines	357	3,962	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Other machinery, except electrical	351-56,358-59	1,939	(D)	(D)	(D)	(D)	(D)	2,396	2,428	2,719	(D)	(D)
Electrical equipment	36	9,175	10,329	10,923	12,681	13,778	14,432	14,980	15,848	16,242	16,929	17,397
Radio and TV receiving equipment	365	556	(D)	(D)	(D)	(D)	(D)	133	139	139	84	93
Communication equipment	366	4,024	4,758	5,839	7,298	8,685	9,397	9,669	10,184	10,296	10,539	10,373
Electronic components	367	1,547	1,573	1,740	2,169	2,831	3,385	(D)	4,286	4,607	4,990	5,505
Other electrical equipment	361-64,369	3,016	(D)	(D)	(D)	(D)	(D)	(D)	1,239	1,200	1,316	1,426
Transportation equipment	37	14,315	(D)	(D)	(D)	(D)	(D)	31,275	34,246	36,338	36,844	35,900
Motor vehicles and motor vehicles equipment	371	4,955	4,806	4,797	5,318	6,057	6,984	(D)	(D)	(D)	(D)	(D)
Other transportation equipment	373-75,379	162	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Aircraft and missiles	372,376	9,198	11,968	14,451	15,406	18,858	22,231	21,050	24,458	25,900	25,638	25,357

See explanatory information and SOURCE at end of table.

Table A-3. Total (company, Federal, and other) funds for industrial R&D performance, by industry and size of company: 1980-90

[Dollars in millions]

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Industry and size of company Distribution by industry	SIC code	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Professional and scientific instruments..............	38	$3,029	$3,614	$3,930	$4,266	$4,602	$5,013	$5,103	$5,222	$5,426	$5,743	$6,163
Scientific and mechanical measuring instrumei	381-82	1,352	(D)	(D)	(D)	(D)	(D)	(D)	(D)	1,734	1,868	2,086
Optical, surgical, photographic, and other instruments..	383-87	1,677	(D)	(D)	(D)	(D)	(D)	(D)	(D)	3,692	3,875	4,077
Other manufacturing industries 1/......................	27,31,39	364	(D)	(D)	(D)	(D)	(D)	382	(D)	(D)	(D)	(D)
Nonmanufacturing industries............................	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	1,815	1,306	2,472	3,337	4,905	6,714	7,446	7,844	8,113	8,286	9,258
Distribution by size of company - [Based on number of employees]												
Less than 500 2/..		2,065	2,305	2,934	4,422	4,402	5,866	7,071	7,163	(S)	7,620	(S)
500 to 999 3/..		N/A	N/A	N/A	N/A	1,439	1,648	1,902	1,725	1,656	1,765	1,956
1,000 to 4,999..		2,701	3,148	3,864	4,178	5,520	6,240	7,472	7,262	7,598	7,896	7,378
5,000 to 9,999..		2,028	2,988	2,751	2,798	3,251	4,022	4,251	4,501	5,236	5,626	6,145
10,000 to 24,999..		6,017	6,762	7,943	9,499	11,351	11,109	10,493	12,043	11,473	10,185	11,771
25,000 or more..		31,693	36,607	41,156	44,372	48,837	55,354	56,991	59,461	64,677	68,962	68,921

1/ Until 1984, tobacco products (SIC 21) was included with "other manufacturing industries."
2/ Until 1984, data represent companies with less than 1,000 employees.
3/ See footnote #2
(D) Data have been withheld to avoid disclosing operations of individual companies.
(S) Data have been withheld due to imputation of more than 50 percent.

N/A Not available

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-4. Total (company, Federal, and other) funds for industrial R&D performance, by industry, by size of company: 1990

[Dollars in millions]

Page 1 of 2

Industry	SIC code	Total	Size of company: Less than 500 employees	500 to 999 employees	1,000 to 4,999 employees	5,000 to 9,999 employees	10,000 to 24,999 employees	25,000 or more employees
Total		$104,344	(S)	$1,956	$7,378	$6,145	$11,771	$68,921
Food, kindred, and tobacco products	20,21	(D)	(S)	25	127	146	227	(D)
Textiles and apparel	22,23	(D)	(S)	(S)	39	6	(S)	(D)
Lumber, wood products, and furniture	24,25	180	(D)	(S)	42	44	57	(D)
Paper and allied products	26	736	(S)	(S)	67	85	310	173
Chemicals and allied products	28	12,565	(D)	(D)	(D)	877	(D)	5,156
Industrial chemicals	281-82,286	4,344	(S)	(D)	(D)	(D)	(D)	(D)
Drugs and medicines	283	(D)	(D)	40	346	(D)	(D)	1,822
Other chemicals	284-85,287-89	(D)	635	(D)	535	(D)	(S)	(D)
Petroleum refining and extraction	13,29	2,099	9	(S)	(D)	(D)	(D)	1,668
Rubber products	30	(D)	(S)	(D)	131	(D)	(D)	(D)
Stone, clay, and glass products	32	(D)	(S)	(S)	50	(D)	316	(D)
Primary metals	33	(D)	(D)	(D)	(D)	136	(D)	(D)
Ferrous metals and products	331-32,3398-99	(D)	(S)	(D)	(D)	65	(D)	(D)
Nonferrous metals and products	333-36	(D)	(D)	(S)	(D)	(S)	(D)	(D)
Fabricated metal products	34	808	(D)	58	(D)	(D)	(D)	(D)
Machinery	35	14,700	(S)	385	1,226	(D)	(D)	(D)
Office, computing, and accounting machines	357	(D)	(S)	205	(D)	(D)	(D)	(D)
Other machinery, except electrical	351-56,358-59	(D)	(S)	180	(D)	(D)	(D)	(D)
Electrical equipment	36	17,397	1,640	330	1,184	779	2,233	11,231
Radio and TV receiving equipment	365	93	(S)	(D)	(D)	(D)	0	0
Communication equipment	366	10,373	(D)	(D)	(D)	73	(D)	8,571
Electronic components	367	5,505	884	(D)	546	(D)	(D)	(D)
Other electrical equipment	361-64,369	1,426	(D)	83	361	(D)	(D)	(D)
Transportation equipment	37	35,900	(D)	(D)	(D)	(D)	1,139	(D)
Motor vehicles and motor vehicles equipment	371	(D)	(D)	16	40	154	(D)	(D)
Other transportation equipment	373-75,379	(D)	(S)	(D)	23	(D)	(D)	0
Aircraft and missiles	372,376	25,357	(D)	(D)	(D)	135	(D)	24,329

See explanatory information and SOURCE at end of table.

Table A-4. Total (company, Federal, and other) funds for industrial R&D performance, by industry, by size of company: 1990

[Dollars in millions]

Page 2 of 2

Industry	SIC code	Total	Less than 500 employees	500 to 999 employees	1,000 to 4,999 employees	5,000 to 9,999 employees	10,000 to 24,999 employees	25,000 or more employees
			Size of company					
Professional and scientific instruments	38	$6,163	(S)	(D)	(D)	338	(D)	(D)
Scientific and mechanical measuring instruments	381-82	2,086	(D)	75	246	37	(D)	(D)
Optical, surgical, photographic, and other instruments	383-87	4,077	(D)	(D)	(D)	301	(D)	2,862
Other manufacturing industries	27,31,39	(D)	(S)	31	(D)	102	168	(D)
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	9,258	(S)	707	1,949	(D)	(D)	1,519

(D) Data have been withheld to avoid disclosing operations of individual companies.
(S) Data have been withheld due to imputation of more than 50 percent.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-5. Total (company, Federal, and other) funds for industrial R&D performance, by industry and size of company, by size of R&D program: 1990

Page 1 of 2

Industry and size of company	SIC code	Total	Size of R&D program [Dollars in thousands] Less than $200	$200 to $999	$1,000 to $9,999	$10,000 to $99,999	$100,000 or more
			[Dollars in millions]				
Total		$104,344	(S)	(S)	$6,974	$13,449	$80,368
Distribution by industry							
Food, kindred, and tobacco products	20,21	(D)	(S)	(S)	121	792	(D)
Textiles and apparel	22,23	(D)	(D)	(S)	50	136	0
Lumber, wood products, and furniture	24,25	180	(S)	(S)	66	97	0
Paper and allied products	26	736	(D)	(S)	89	437	(D)
Chemicals and allied products	28	12,565	(S)	(S)	674	1,783	9,786
Industrial chemicals	281-82,286	4,344	(D)	(D)	110	811	3,395
Drugs and medicines	283	(D)	(S)	(D)	34	370	5,175
Other chemicals	284-85,287-89	(D)	(D)	(S)	530	603	1,216
Petroleum refining and extraction	13,29	2,099	(S)	(S)	24	318	1,749
Rubber products	30	(D)	(S)	(S)	77	250	(D)
Stone, clay, and glass products	32	(D)	(S)	(S)	41	276	(D)
Primary metals	33	(D)	(S)	(S)	110	450	(D)
Ferrous metals and products	331-32,3398-99	(D)	(D)	(S)	60	160	0
Nonferrous metals and products	333-36	(D)	(D)	(S)	50	290	(D)
Fabricated metal products	34	808	(D)	(S)	180	365	(D)
Machinery	35	14,700	(D)	(S)	1,302	1,738	(D)
Office, computing, and accounting machines	357	(D)	(D)	(S)	(S)	677	10,355
Other machinery, except electrical	351-56,358-59	(D)	(D)	(S)	549	1,062	(D)
Electrical equipment	36	17,397	(S)	(S)	1,523	2,081	13,266
Radio and TV receiving equipment	365	93	(D)	(S)	16	(D)	0
Communication equipment	366	10,373	(S)	(S)	358	428	9,444
Electronic components	367	5,505	(S)	(S)	745	977	(D)
Other electrical equipment	361-64,369	1,426	(D)	(S)	404	(D)	(D)
Transportation equipment	37	35,900	(S)	(S)	124	782	34,929
Motor vehicles and motor vehicles equipment	371	(D)	(S)	(S)	68	294	(D)
Other transportation equipment	373-75,379	(D)	(D)	(D)	36	126	(D)
Aircraft and missiles	372,376	25,357	(D)	(D)	20	362	24,970

See explanatory information and SOURCE at end of table.

Table A-5. Total (company, Federal, and other) funds for industrial R&D performance, by industry and size of company, by size of R&D program: 1990

Page 2 of 2

Industry and size of company	SIC code	Total	Size of R&D program [Dollars in thousands] Less than $200	$200 to $999	$1,000 to $9,999	$10,000 to $99,999	$100,000 or more
Distribution by industry			[Dollars in millions]				
Professional and scientific instruments	38	$6,163	(S)	(S)	$517	$778	$4,533
Scientific and mechanical measuring instruments	381-82	2,086	(D)	(S)	306	283	(D)
Optical, surgical, photographic, and other instruments	383-87	4,077	(D)	(S)	211	495	(D)
Other manufacturing industries	27,31,39	(D)	(D)	(S)	108	312	0
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	9,258	(S)	(S)	1,968	2,354	2,966
Distribution by size of company [Based on number of employees]							
Less than 500		(S)	(S)	(S)	4,288	653	0
500 to 999		1,956	(S)	(S)	681	1,122	0
1,000 to 4,999		7,378	(S)	(S)	1,482	4,836	920
5,000 to 9,999		6,145	(S)	(S)	323	2,528	3,277
10,000 to 24,999		11,771	(D)	(D)	149	2,744	8,871
25,000 or more		68,921	(D)	(D)	51	1,566	67,300

(D) Data have been withheld to avoid disclosing operations of individual companies.
(S) Data have been withheld due to imputation of more than 50 percent.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-6. Number of R&D-performing companies, by industry and size of company, by size of R&D program: 1990

Size of R&D program
[Dollars in thousands]

Page 1 of 2

Industry and size of company	SIC code	Total	Less than $200	$200 to $999	$1,000 to $9,999	$10,000 to $99,999	$100,000 or more
Total		24,531	15,419	6,273	2,279	440	120
Food, kindred, and tobacco products	20,21	132	32	40	32	26	2
Textiles and apparel	22,23	457	311	119	19	8	0
Lumber, wood products, and furniture	24,25	152	98	26	23	5	0
Paper and allied products	26	325	122	162	27	13	1
Chemicals and allied products	28	2,462	1,710	513	162	50	27
Industrial chemicals	281-82,286	250	104	101	20	17	8
Drugs and medicines	283	436	202	201	9	9	15
Other chemicals	284-85,287-89	1,776	1,404	211	133	24	4
Petroleum refining and extraction	13,29	134	104	6	7	10	7
Rubber products	30	485	392	55	24	12	2
Stone, clay, and glass products	32	154	90	38	15	9	2
Primary metals	33	250	124	84	25	16	1
Ferrous metals and products	331-32,3398-99	120	39	61	14	6	0
Nonferrous metals and products	333-36	130	85	23	11	10	1
Fabricated metal products	34	1,941	1,686	164	80	10	1
Machinery	35	2,791	1,635	623	450	65	18
Office, computing, and accounting machines	357	499	100	108	252	25	14
Other machinery, except electrical	351-56,358-59	2,292	1,535	515	198	40	4
Electrical equipment	36	3,670	2,078	1,089	415	68	20
Radio and TV receiving equipment	365	179	147	27	4	1	0
Communication equipment	366	663	204	346	87	15	11
Electronic components	367	1,339	688	427	186	31	7
Other electrical equipment	361-64,369	1,489	1,039	289	138	21	2
Transportation equipment	37	270	31	155	38	25	21
Motor vehicles and motor vehicles equipment	371	159	8	122	18	8	3
Other transportation equipment	373-75,379	67	21	25	17	3	1
Aircraft and missiles	372,376	44	2	8	3	14	17

See explanatory information and SOURCE at end of table.

Table A-6. Number of R&D-performing companies, by industry, size of company, and size of R&D program: 1990

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			Size of R&D program [Dollars in thousands]				
Industry and size of company	SIC code	Total	Less than $200	$200 to $999	$1,000 to $9,999	$10,000 to $99,999	$100,000 or more
Professional and scientific instruments	38	1872	1020	641	174	29	8
Scientific and mechanical measuring instruments	381-82	992	641	226	109	14	2
Optical, surgical, photographic, and other instruments	383-87	880	379	415	65	15	6
Other manufacturing industries	27,31,39	397	327	27	33	10	0
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	9039	5659	2531	755	84	10
Distribution by size of company [Based on number of employees]							
Less than 500		22,280	15,007	5,674	1,568	31	0
500 to 999		751	161	326	220	44	0
1,000 to 4,999		999	219	229	371	174	6
5,000 to 9,999		200	12	25	74	74	15
10,000 to 24,999		169	3	14	36	81	35
25,000 or more		132	17	5	10	36	64

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-7. Company and other (except Federal) funds for industrial R&D performance, by industry and size of company: 1980-90

[Dollars in millions]

Page 1 of 2

Industry and size of company	SIC code	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Total		$30,476	$35,428	$40,105	$44,588	$51,404	$57,043	$59,932	$61,403	$65,772	$70,562	$73,764
Distribution by industry												
Food, kindred, and tobacco products 1/	20,21	(D)	636	777	824	1,081	1,136	1,280	1,204	1,192	1,284	1,376
Textiles and apparel	22,23	(D)	116	136	150	182	218	246	243	210	(S)	(S)
Lumber, wood products, and furniture	24,25	(D)	161	159	152	143	147	144	137	156	172	180
Paper and allied products	26	(D)	566	566	552	594	576	538	604	664	686	736
Chemicals and allied products	28	4,264	5,205	6,197	6,792	7,736	8,310	8,664	9,445	10,573	11,383	12,498
Industrial chemicals	281-82,286	1,856	2,393	2,810	2,828	3,057	3,281	3,374	3,531	3,763	3,960	4,280
Drugs and medicines	283	(D)	2,064	2,473	2,896	3,310	3,481	3,657	4,095	4,743	5,164	5,651
Other chemicals	284-85,287-89	653	747	914	1,068	1,369	1,548	1,633	1,819	2,067	2,259	2,567
Petroleum refining and extraction	13,29	1,401	1,780	2,003	2,074	2,245	2,194	1,971	1,883	1,923	2,050	2,083
Rubber products	30	(D)	598	617	638	671	659	655	596	635	678	732
Stone, clay, and glass products	32	(D)	411	472	586	705	825	941	985	826	863	893
Primary metals	33	594	702	711	701	683	730	786	711	642	715	774
Ferrous metals and products	331-32,3398-99	338	415	426	396	357	323	336	249	257	254	240
Nonferrous metals and products	333-36	256	287	285	305	326	407	450	462	385	461	534
Fabricated metal products	34	501	545	565	634	773	780	800	633	687	664	675
Machinery	35	5,254	6,124	7,227	7,911	9,312	10,721	10,701	10,577	11,992	13,478	13,804
Office, computing, and accounting machines	357	(D)	3,847	4,944	5,634	7,011	8,418	8,380	8,193	9,371	10,780	11,050
Other machinery, except electrical	351-56,358-59	(D)	2,277	2,283	2,277	2,301	2,303	2,321	2,384	2,621	2,698	2,754
Electrical equipment	36	5,431	6,409	6,682	8,158	9,037	9,271	9,767	10,449	11,061	11,641	11,768
Radio and TV receiving equipment	365	346	358	364	324	362	350	133	139	139	84	93
Communication equipment	366	2,367	2,975	3,555	4,500	5,147	5,174	5,117	5,455	5,675	5,820	5,533
Electronic components	367	1,165	1,212	1,342	1,810	2,354	2,826	3,357	3,630	4,068	4,458	4,747
Other electrical equipment	361-64,369	1,553	1,864	1,421	1,524	1,174	921	1,160	1,225	1,179	1,279	1,395
Transportation equipment	37	6,958	7,739	8,621	8,991	10,406	12,092	13,567	13,462	14,162	15,083	14,992
Motor vehicles and motor vehicles equipment	371	4,300	4,219	4,321	4,754	5,384	6,164	7,171	7,167	7,769	8,725	8,550
Other transportation equipment	373-75,379	(D)	80	114	227	256	279	330	386	370	353	302
Aircraft and missiles	372,376	2,570	3,440	4,186	4,010	4,764	5,649	6,066	5,939	6,023	6,005	6,140

See explanatory information and SOURCE at end of table.

Table A-7. Company and other (except Federal) funds for industrial R&D performance, by industry and size of company: 1980-90

[Dollars in millions]

Page 2 of 2

Industry and size of company Distribution by industry	SIC code	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Professional and scientific instruments................	38	$2,456	$2,978	$3,407	$3,816	$4,211	$4,622	$4,752	$4,950	$5,306	$5,630	$6,064
Scientific and mechanical measuring instrument	381-82	1,001	1,235	1,363	1,605	1,671	1,596	1,521	1,598	1,710	1,858	2,076
Optical, surgical, photographic, and other instruments..	383-87	1,454	1,743	2,044	2,211	2,540	3,026	3,231	3,352	3,596	3,772	3,988
Other manufacturing industries 1/........................	27,31,39	339	411	493	525	373	361	380	380	383	400	445
Nonmanufacturing industries..............................	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	1,037	1,048	1,472	2,084	3,252	4,401	4,740	5,144	5,360	5,620	6,515
Distribution by size of company [Based on number of employees]												
Less than 500 2/..		1,711	1,880	2,411	3,781	3,781	5,127	6,203	6,200	(S)	(S)	(S)
500 to 999 3/..		N/A	N/A	N/A	N/A	1,341	1,531	1,765	1,610	1,517	1,660	1,817
1,000 to 4,999..		2,257	2,586	3,241	3,438	4,618	5,249	6,243	6,281	6,441	6,646	6,538
5,000 to 9,999..		1,596	2,369	2,224	2,080	2,764	3,350	3,455	3,753	4,322	4,815	5,867
10,000 to 24,999..		4,867	5,537	6,448	7,228	8,546	8,366	8,489	9,681	9,668	8,948	10,222
25,000 or more..		20,045	23,056	25,781	28,061	30,354	33,421	33,778	33,878	37,438	41,860	42,137

1/ Until 1984, tobacco products (SIC 21) was included with "other manufacturing industries."

2/ Until 1984, data represent companies with less than 1,000 employees.

3/ See footnote #2

(D) Data have been withheld to avoid disclosing operations of individual companies.

(S) Data have been withheld due to imputation of more than 50 percent.

N/A Not available

NOTE: Company funds include all funds for industrial R&D work performed within company facilities from all sources except the Federal Government. The sources of funds may comprise those from outside organizations such as research institutions, universities and colleges, other nonprofit organizations, other companies, and state governments, as well as companies' own. Company-financed R&D not performed within the company is excluded.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-8. Company and other (except Federal) funds for industrial R&D performance, by industry, by size of company: 1990

[Dollars in millions]

Industry	SIC code	Total	Size of company: Less than 500 employees	500 to 999 employees	1,000 to 4,999 employees	5,000 to 9,999 employees	10,000 to 24,999 employees	25,000 or more employees
Total		$73,764	(S)	$1,817	$6,538	$5,867	$10,222	$42,137
Food, kindred, and tobacco products	20,21	1,376	(S)	(S)	(S)	146	227	849
Textiles and apparel	22,23	(S)	(D)	(S)	39	6	(S)	(D)
Lumber, wood products, and furniture	24,25	180	(D)	(S)	(S)	44	57	(D)
Paper and allied products	26	736	(S)	(S)	87	85	310	173
Chemicals and allied products	28	12,498	763	139	1,168	865	4,377	5,147
Industrial chemicals	281-82,286	4,280	(S)	53	287	499	530	2,875
Drugs and medicines	283	5,651	(S)	40	346	(D)	3,070	(D)
Other chemicals	284-85,287-89	2,567	636	46	535	(D)	(S)	(D)
Petroleum refining and extraction	13,29	2,083	9	(S)	60	53	294	1,664
Rubber products	30	732	(S)	(D)	131	163	(D)	(D)
Stone, clay, and glass products	32	893	(S)	(S)	50	(D)	314	(D)
Primary metals	33	774	(S)	(S)	206	138	131	270
Ferrous metals and products	331-32,3398-99	240	(S)	(S)	66	65	(D)	(D)
Nonferrous metals and products	333-36	534	(S)	(S)	140	(S)	(D)	(D)
Fabricated metal products	34	675	(D)	58	130	155	105	(D)
Machinery	35	13,804	(S)	385	1,117	2,164	806	8,094
Office, computing, and accounting machines	357	11,050	(S)	205	418	1,956	386	7,378
Other machinery, except electrical	351-56,358-59	2,754	(S)	180	699	208	420	716
Electrical equipment	36	11,768	1,574	(S)	1,088	691	1,880	6,307
Radio and TV receiving equipment	365	93	(S)	(D)	(D)	(D)	0	0
Communication equipment	366	5,533	365	68	210	(D)	(D)	4,205
Electronic components	367	4,747	835	91	509	477	910	1,925
Other electrical equipment	361-64,369	1,395	(S)	(D)	(D)	120	(D)	177
Transportation equipment	37	14,992	(S)	(S)	167	(D)	615	(D)
Motor vehicles and motor vehicles equipment	371	8,550	(D)	(S)	(S)	164	134	(D)
Other transportation equipment	373-75,379	302	(S)	(D)	23	(D)	253	0
Aircraft and missiles	372,376	6,140	(D)	(D)	104	117	228	5,670

See explanatory information and SOURCE at end of table.

Table A-8. Company and other (except Federal) funds for industrial R&D performance, by industry, by size of company: 1990

[Dollars in millions]

Industry	SIC code	Total	Size of company Less than 500 employees	500 to 999 employees	1,000 to 4,999 employees	5,000 to 9,999 employees	10,000 to 24,999 employees	25,000 or more employees
Professional and scientific instruments	38	$6,064	(S)	$144	$571	$338	$338	$4,041
Scientific and mechanical measuring instruments	381-82	2,076	(S)	75	246	37	(D)	(D)
Optical, surgical, photographic, and other instruments	383-87	3,988	(S)	69	325	301	(D)	(D)
Other manufacturing industries	27,31,39	445	(S)	(D)	114	102	168	(D)
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	6,515	(S)	674	1,440	598	(D)	772

(D) Data have been withheld to avoid disclosing operations of individual companies.
(S) Data have been withheld because of imputation of more than 50 percent.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-9. Company-financed research and development performed outside the United States by U.S. domestic companies and their foreign subsidiaries, by selected industry: 1980-90--

[Dollars in millions]

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Industry	SIC code	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Total		$3,165	$3,393	$3,094	$3,269	$3,633	$3,650	$4,624	$5,226	$6,295	$6,814	$7,810
Food, kindred, and tobacco products 1/	20,21	54	62	64	63	70	75	69	37	27	41	53
Chemicals and allied products	28	603	715	682	729	786	843	1,071	1,243	1,501	1,504	2,005
Industrial and other chemicals	281-82,284-89	246	287	319	368	385	444	579	625	781	508	549
Drugs and medicines	283	357	428	363	361	401	399	492	618	720	986	1,456
Petroleum refining and extraction	13,29	141	194	133	103	101	47	40	47	58	45	68
Stone, clay, and glass products	32	21	18	10	19	60	(D)	(D)	(D)	(D)	(D)	(D)
Primary metals	33	11	9	9	10	9	(D)	(D)	18	24	26	30
Fabricated metal products	34	(T)	30	25	23	21	21	26	40	(D)	46	65
Machinery	35	599	612	494	577	740	689	951	1,233	1,364	1,515	1,583
Electrical equipment	36	451	475	467	482	537	591	(S)	432	669	574	674
Radio and TV receiving equipment	365	(T)	(T)	(T)	(T)	(D)	(D)	(D)	0	(D)	(D)	(D)
Communication equipment	366					(D)	(D)	(D)	188	339	271	278
Electronic components	367	29	40	38	(T)	92	117	150	204	278	204	286
Other electrical equipment	361-64,369	11	39	43	38	30	24	25	39	(D)	(D)	(D)
Transportation equipment	37	1,020	884	843	880	907	1,025	(D)	(D)	1,801	(D)	(D)
Motor vehicles and other transportation equipment	371,373-75,379	(T)	(T)	(T)	(T)	(D)	(D)	(D)	(D)	1,469	(D)	(D)
Aircraft and missiles	372,376	(T)	(T)	(T)	(T)	(D)	(D)	182	237	332	614	277
Professional and scientific instruments	38	186	230	237	(T)	263	169	212	317	393	449	601
Other manufacturing industries 1/	22-27,30-31,39	139	156	123	92	131	125	141	138	145	179	187
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	7	8	7	10	8	18	27	64	95	108	126

1/ Until 1984, tobacco products, SIC 21, was included with "other manufacturing industries."

(D) Data have been withheld to avoid disclosing operations of individual companies.

(S) Data have been withheld due to imputation of more than 50 percent.

(T) Data are not separately available, but are included in total.

NOTE: Data are reported in current U.S. dollars.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-10. Federal funds for industrial R&D performance, by industry and size of company: 1980-90

[Dollars in millions]

Page 1 of 2

Industry and size of company	SIC code	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Total		$14,029	$16,382	$18,545	$20,680	$23,396	$27,196	$27,891	$30,752	$32,117	$31,292	$30,580
Distribution by industry												
Food, kindred, and tobacco products 1/	20,21	(D)	(D)	(D)	(D)	(D)	(D)	(D)	2	(D)	(D)	(D)
Textiles and apparel	22,23	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Lumber, wood products, and furniture	24,25	(D)	0	0	0	0	0	0	0	(D)	0	0
Paper and allied products	26	(D)	(D)	0	(D)	(D)	(D)	(D)	(D)	(D)	0	0
Chemicals and allied products	28	372	421	407	393	191	230	179	190	199	83	67
Industrial chemicals	281-82,286	341	409	396	386	183	217	178	185	196	79	64
Drugs and medicines	283	(D)	(D)	(D)	(D)	(D)	(D)	1	(D)	3	(D)	(D)
Other chemicals	284-85,287-89	(D)	(D)	(D)	(D)	(D)	(D)	0	(D)	0	(D)	(D)
Petroleum refining and extraction	13,29	151	(D)	(D)	(D)	(D)	(D)	(D)	14	21	(S)	(S)
Rubber products	30	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Stone, clay, and glass products	32	(D)	(D)	(D)	(D)	(D)	(D)	9	10	(D)	(D)	(D)
Primary metals	33	135	176	276	384	(D)	(D)	(D)	19	21	34	(D)
Ferrous metals and products	331-32,3398-99	105	(D)	(D)	(D)	(D)	(D)	(D)	(D)	1	(D)	(D)
Nonferrous metals and products	333-36	30	(D)	(D)	(D)	10	9	8	(D)	20	(D)	(D)
Fabricated metal products	34	49	80	60	67	69	49	95	150	142	135	133
Machinery	35	647	694	851	1,116	1,192	1,495	(D)	(D)	(D)	1,157	896
Office, computing, and accounting machines	357	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Other machinery, except electrical	351-56,358-59	(D)	(D)	(D)	(D)	(D)	(D)	75	44	98	(D)	(D)
Electrical equipment	36	3,744	3,920	4,241	4,523	4,741	5,161	5,213	5,309	5,181	5,288	5,629
Radio and TV receiving equipment	365	210	(D)	(D)	(D)	(D)	(D)	0	0	0	0	0
Communication equipment	366	1,657	1,783	2,284	2,798	3,538	4,223	4,552	4,729	4,621	4,719	4,840
Electronic components	367	382	361	398	369	477	559	(D)	656	539	532	758
Other electrical equipment	361-64,369	1,495	(D)	(D)	(D)	(D)	(D)	(D)	14	21	37	31
Transportation equipment	37	(D)	(D)	(D)	(D)	(D)	(D)	17,708	20,784	22,176	21,761	20,908
Motor vehicles and motor vehicles equipment	371	655	587	476	564	673	820	(D)	(D)	(D)	(D)	(D)
Other transportation equipment	373-75,379	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Aircraft and missiles	372,376	6,628	8,528	10,265	11,396	14,094	16,582	14,984	18,519	19,677	19,833	19,217

See explanatory information and SOURCE at end of table.

Table A-10. Federal funds for industrial R&D performance, by industry and size of company: 1980-90

[Dollars in millions]

Industry and size of company Distribution by industry	SIC code	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Professional and scientific instruments........................	38	$573	$637	$523	$450	$391	$391	$351	$272	$120	$113	$99
Scientific and mechanical measuring instruments.......	381-82	350	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(S)	(S)	(S)
Optical, surgical, photographic, and other instruments..	383-87	223	(D)	(D)	(D)	(D)	(D)	(D)	(D)	96	103	89
Other manufacturing industries 1/................................	27,31,39	25	(D)	(D)	(D)	(D)	(D)	2	(D)	(D)	(D)	(D)
Nonmanufacturing industries..	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	779	858	1,000	1,253	1,653	2,313	2,706	2,700	2,753	2,666	2,743
Distribution by size of company [Based on number of employees]												
Less than 500 2/..		354	424	523	641	621	739	868	963	864	987	990
500 to 999 3/..		N/A	N/A	N/A	N/A	98	117	137	115	139	105	(S)
1,000 to 4,999..		444	582	623	740	902	991	1,229	981	1,157	1,050	840
5,000 to 9,999..		432	619	527	718	487	672	796	748	914	811	278
10,000 to 24,999..		1,150	1,225	1,495	2,271	2,805	2,743	2,004	2,362	1,805	1,237	1,549
25,000 or more...		11,648	13,551	15,377	16,311	18,483	21,933	23,213	25,583	27,239	27,102	26,784

1/ Until 1984, tobacco products, SIC 21, was included with "other manufacturing industries."
2/ Until 1984, data represent companies with less than 1,000 employees.
3/ See footnote #2
(D) Data have been withheld to avoid disclosing operations of individual companies.
(S) Data have been withheld due to imputation of more than 50 percent.

N/A Not available

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-11. Federal funds for industrial R&D performance, by industry, by size of company: 1990

[Dollars in millions]

Industry	SIC code	Total	Size of company Less than 500 employees	500 to 999 employees	1,000 to 4,999 employees	5,000 to 9,999 employees	10,000 to 24,999 employees	25,000 or more employees
Total		$30,580	$990	(S)	$840	$278	$1,549	$26,784
Food, kindred, and tobacco products	20,21	(D)	0	0	0	0	0	(D)
Textiles and apparel	22,23	(D)	(D)	0	0	0	0	0
Lumber, wood products, and furniture	24,25	0	0	0	0	0	0	0
Paper and allied products	26	0	0	0	0	0	0	0
Chemicals and allied products	28	67	(D)	(D)	(D)	12	(D)	9
Industrial chemicals	281-82,286	64	0	(D)	(D)	(D)	(D)	(D)
Drugs and medicines	283	(D)	(D)	0	0	(D)	(D)	(D)
Other chemicals	284-85,287-89	(D)	0	(D)	0	0	0	0
Petroleum refining and extraction	13,29	(S)	0	0	(D)	(D)	(D)	3
Rubber products	30	(D)	0	(D)	0	(D)	0	0
Stone, clay, and glass products	32	(D)	0	0	0	0	2	(D)
Primary metals	33	(D)	(D)	(D)	(D)	0	(D)	(D)
Ferrous metals and products	331-32,3398-99	(D)	0	(D)	(D)	0	0	(D)
Nonferrous metals and products	333-36	(D)	(D)	0	(D)	0	(D)	(D)
Fabricated metal products	34	133	0	0	(D)	(D)	(D)	(D)
Machinery	35	896	(S)	0	110	(D)	(D)	(D)
Office, computing, and accounting machines	357	(D)	0	0	(D)	(D)	(D)	(D)
Other machinery, except electrical	351-56,358-59	(D)	(S)	0	(D)	(D)	(D)	(D)
Electrical equipment	36	5,629	65	(S)	96	88	363	4,925
Radio and TV receiving equipment	365	0	0	0	0	0	0	0
Communication equipment	366	4,840	(D)	(D)	(D)	(D)	(D)	4,365
Electronic components	367	758	49	(D)	36	(D)	(D)	(D)
Other electrical equipment	361-64,369	3[illegible]	(D)	(D)	(D)	(D)	0	(D)
Transportation equipment	37	20,908	(D)	(D)	(D)	(D)	525	(D)
Motor vehicles and motor vehicles equipment	371	(D)	0	0	0	0	(D)	(D)
Other transportation equipment	373-75,379	(D)	0	0	0	(D)	(D)	0
Aircraft and missiles	372,376	19,217	(D)	(D)	(D)	18	(D)	18,868

See explanatory information and SOURCE at end of table.

Table A-11. Federal funds for industrial R&D performance, by industry, by size of company: 1990

[Dollars in millions]

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Industry	SIC code	Total	Less than 500 employees	500 to 999 employees	1,000 to 4,999 employees	5,000 to 9,999 employees	10,000 to 24,999 employees	25,000 or more employees
			Size of company					
Professional and scientific instruments........................	38	$99	(S)	(D)	(D)	$0	(D)	(D)
Scientific and mechanical measuring instruments......	381-82	(S)	(D)	$0	$0	0	(D)	$0
Optical, surgical, photographic, and other instruments..	383-87	89	(D)	(D)	(D)	0	(D)	(D)
Other manufacturing industries..................................	27,31,39	(D)	$0	(D)	(D)	0	$0	0
Nonmanufacturing industries......................................	10-11,14-17,40-42,44-51,53-54,58,60,62-63,72-73,78,806-07,87	2,743	(S)	(S)	508	(D)	(D)	747

(D) Data have been withheld to avoid disclosing operations of individual companies.
(S) Data have been withheld due to imputation of more than 50 percent.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-12. Number of R&D-performing companies reporting Federal R&D funds, by industry, by size of company: 1990

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Industry	SIC code	Less than 500 employees		500 to 999 employees		1,000 to 4,999 employees		5,000 to 9,999 employees		10,000 to 24,999 employees		25,000 or more employees	
		Total	Federal	Total	Federal	Total	Federal	Total	Federal	Total	Federal	Total	Federal
Total		22,280	1,226	751	41	999	48	200	24	169	38	132	52
Food, kindred, and tobacco products	20,21	8	0	34	0	46	0	16	0	14	0	14	1
Textiles and apparel	22,23	286	1	108	0	43	0	7	0	11	0	2	0
Lumber, wood products, and furniture	24,25	79	0	28	0	32	0	9	0	3	0	1	0
Paper and allied products	26	256	0	13	0	32	0	11	0	9	0	4	0
Chemicals and allied products	28	2,326	100	33	3	58	3	15	4	20	5	10	5
Industrial chemicals	281-82,286	204	0	9	1	19	3	8	3	5	3	5	3
Drugs and medicines	283	407	100	6	1	8	0	2	1	9	2	4	2
Other chemicals	284-85,287-89	1,715	0	18	1	31	0	5	0	6	0	1	0
Petroleum refining and extraction	13,29	104	0	4	0	10	1	5	1	4	2	7	3
Rubber products	30	308	0	36	1	129	0	6	1	4	0	2	0
Stone, clay, and glass products	32	88	0	25	0	30	0	3	0	6	3	2	1
Primary metals	33	169	2	22	1	41	4	10	0	5	2	3	2
Ferrous metals and products	331-32,3398-99	79	0	10	1	22	1	6	0	1	0	2	1
Nonferrous metals and products	333-36	90	2	12	0	19	3	4	0	4	2	1	1
Fabricated metal products	34	1,796	0	71	0	58	2	9	2	6	1	1	1
Machinery	35	2,539	41	89	0	120	6	26	2	10	2	7	3
Office, computing, and accounting machines	357	438	0	17	0	27	1	10	1	3	1	4	2
Other machinery, except electrical	351-56,358-59	2,101	41	72	0	93	5	16	1	7	1	3	1
Electrical equipment	36	3,414	145	101	19	107	13	17	6	15	4	16	13
Radio and TV receiving equipment	365	172	0	3	0	3	0	1	0	0	0	0	0
Communication equipment	366	614	2	15	3	17	6	4	2	5	3	8	7
Electronic components	367	1,258	141	32	2	35	6	7	3	4	1	3	3
Other electrical equipment	361-64,369	1,370	2	51	14	52	1	5	1	6	0	5	3
Transportation equipment	37	156	1	28	1	40	4	12	5	16	8	18	16
Motor vehicles and motor vehicles equipment	371	100	0	21	0	22	0	6	0	6	2	4	2
Other transportation equipment	373-75,379	53	0	2	0	7	0	1	1	4	2	0	0
Aircraft and missiles	372,376	3	1	5	1	11	4	5	4	6	4	14	14

See explanatory information and SOURCE at end of table.

Table A-12. Number of R&D-performing companies reporting Federal R&D funds, by industry, by size of company: 1990

Page 2 of 2

Industry	SIC code	Size of company											
		Less than 500 employees		500 to 999 employees		1,000 to 4,999 employees		5,000 to 9,999 employees		10,000 to to 24,999 employees		25,000 or more employees	
		Total	Federal	Total	Federal	Total	Federal	Total	Federal	Total	Federal	Total	Federal
Professional and scientific instruments........	38	1,778	19	36	1	43	2	7	0	3	2	5	2
Scientific and mechanical measuring instruments..	381-82	954	18	14	0	19	0	3	0	1	1	1	0
Optical, surgical, photographic, and other instruments..	383-87	824	1	22	1	24	2	4	0	2	1	4	2
Other manufacturing industries....................	27,31,39	309	0	35	2	36	1	8	0	7	0	2	0
Nonmanufacturing industries........................	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	8,664	917	88	13	174	12	39	3	36	9	38	5

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-13. Industry-administered federally funded R&D centers--funds by character of work, full-time-equivalent (FTE) R&D scientists and engineers, and total number of employees: 1988-90

Page 1 of 1

[Dollars in millions]

Item	1988	1989	1990
Total R&D funds	$2,538	$2,632	$2,764
Basic research	337	398	499
Applied research	466	475	488
Development	1,735	1,759	1,777
		January	
	1989	1990	1991
Number of FTE R&D scientists and engineers	14,370	14,982	15,198
		March	
	1988	1989	1990
Total employment	41,277	40,690	41,781

NOTE: Industry-administered Federally funded research and development centers centers (FFRDCs) conduct R&D almost exclusively for use by the Federal Government. Data for these FFRDCs administered by industry are included in Federal R&D support under the industry classifications of the administering firms. See section C for a listing of industry-administered FFRDCs and their locations.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-14. Number of R&D-performing companies in manufacturing and nonmanufacturing industries, by size of company: 1990

Page 1 of 1

Size of company [Based on number of employees]	Number of companies reporting R&D funds		
	Total	Manufacturing	Nonmanufacturing
Total	24,531	15,492	9,039
Less than 500	22,280	13,616	8,664
500 to 999	751	653	98
1,000 to 4,999	999	825	174
5,000 to 9,999	200	161	39
10,000 to 24,999	169	133	36
25,000 or more	132	94	38

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-15. Concentration of total, Federal, and company and other R&D funds, and net sales of R&D-performing companies: 1980-90

Companies ranked by size of R&D program	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
	Percent of total (company, Federal, and other) R&D funds ranked by size of total R&D funds										
First 4 (1-4)	17 %	18 %	20 %	19 %	17 %	18 %	19 %	19 %	18 %	19 %	18 %
Next 4 (5-8)	14	12	12	11	13	12	11	12	12	13	12
Next 12 (9-20)	18	20	19	17	17	17	14	16	17	16	16
Next 20 (21-40)	13	12	13	13	13	13	13	12	12	12	12
Next 60 (41-100)	15	18	16	17	18	16	15	14	15	15	16
Next 100 (101-200)	9	9	9	9	9	9	10	8	8	8	9
Next 200 (201-400)	6	6	6	6	6	5	8	6	7	6	7
	Percent of Federal R&D funds ranked by size of Federal R&D funds										
First 4 (1-4)	N/A	N/A	N/A	N/A	30 %	29 %	30 %	31 %	32 %	36 %	38 %
Next 4 (5-8)	N/A	N/A	N/A	N/A	15	15	16	18	18	15	16
Next 12 (9-20)	N/A	N/A	N/A	N/A	26	27	28	27	28	30	26
Next 20 (21-40)	N/A	N/A	N/A	N/A	17	16	15	15	15	11	12
Next 60 (41-100)	N/A	N/A	N/A	N/A	10	7	7	7	6	6	6
Next 100 (101-200)	N/A	N/A	N/A	N/A	1	2	2	1	3	1	1
Next 200 (201-400)	N/A	N/A	N/A	N/A	0	0	1	0	0	0	0
	Percent of company and other (except Federal) R&D funds ranked by size of company and other R&D funds										
First 4 (1-4)	N/A	N/A	N/A	N/A	22 %	23 %	20 %	20 %	21 %	22 %	20 %
Next 4 (5-8)	N/A	N/A	N/A	N/A	8	7	7	7	7	7	7
Next 12 (9-20)	N/A	N/A	N/A	N/A	12	12	12	12	12	13	13
Next 20 (21-40)	N/A	N/A	N/A	N/A	12	12	10	11	12	12	12
Next 60 (41-100)	N/A	N/A	N/A	N/A	18	18	16	16	16	16	17
Next 100 (101-200)	N/A	N/A	N/A	N/A	11	10	10	10	10	10	10
Next 200 (201-400)	N/A	N/A	N/A	N/A	7	7	8	8	8	8	8
	Percent of net sales ranked by size of total R&D funds										
First 4 (1-4)	N/A	N/A	N/A	N/A	7 %	8 %	8 %	7 %	7 %	6 %	5 %
Next 4 (5-8)	N/A	N/A	N/A	N/A	4	4	5	5	5	5	5
Next 12 (9-20)	N/A	N/A	N/A	N/A	5	5	5	5	5	5	5
Next 20 (21-40)	N/A	N/A	N/A	N/A	8	8	7	7	6	5	5
Next 60 (41-100)	N/A	N/A	N/A	N/A	12	12	10	11	11	12	13
Next 100 (101-200)	N/A	N/A	N/A	N/A	13	13	10	8	9	8	9
Next 200 (201-400)	N/A	N/A	N/A	N/A	14	15	9	12	10	11	11

N/A Not available

NOTE: Companies were ranked individually for each year; therefore, particular companies comprising the size groups may have changed from year to year

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-16. Domestic net sales of R&D-performing companies, by industry, by size of company: 1989-90

[Dollars in millions]

Industry	SIC code	Total	1989 Size of company Less than 500 employees	500 to 999 employees	1,000 to 4,999 employees	5,000 to 9,999 employees	10,000 to 24,999 employees	25,000 or more employees
Total		$2,544,772	(S)	(S)	$351,963	$239,823	$467,815	$1,241,889
Food, kindred, and tobacco products	20,21	258,447	(S)	(S)	32,356	30,622	43,722	145,724
Textiles and apparel	22,23	(S)	(S)	(S)	8,017	(S)	15,610	16,561
Lumber, wood products, and furniture	24,25	25,111	(D)	(S)	9,466	3,900	5,576	(D)
Paper and allied products	26	96,887	(S)	(S)	(S)	9,443	34,233	35,574
Chemicals and allied products	28	213,619	(S)	5,855	41,819	13,901	60,208	78,148
Industrial chemicals	281-82,286	91,531	(S)	1,892	13,949	9,894	15,897	48,565
Drugs and medicines	283	56,551	(S)	635	7,498	(D)	27,820	(D)
Other chemicals	284-85,287-89	65,537	(S)	3,328	20,372	(D)	16,491	(D)
Petroleum refining and extraction	13,29	214,844	(D)	(D)	(S)	18,152	41,135	140,012
Rubber products	30	40,991	(S)	(D)	9,548	4,739	11,835	(D)
Stone, clay, and glass products	32	37,631	(D)	(S)	(S)	3,317	13,311	(D)
Primary metals	33	83,461	(S)	(S)	15,684	12,863	19,292	30,194
Ferrous metals and products	331-32,3398-99	45,705	(D)	(S)	(S)	6,631	6,835	(D)
Nonferrous metals and products	333-36	37,756	(D)	(S)	8,834	6,232	12,457	(D)
Fabricated metal products	34	64,274	(S)	(S)	(S)	10,095	15,811	0
Machinery	35	169,181	(S)	16,989	33,557	24,863	19,598	53,634
Office, computing, and accounting machines	357	80,027	$3,529	10,863	6,964	14,374	4,701	39,596
Other machinery, except electrical	351-56,358-59	89,154	(S)	6,126	26,593	10,[illegible]	14,897	14,036
Electrical equipment	36	236,806	(S)	8,318	32,112	15,998	26,730	130,051
Radio and TV receiving equipment	365	3,007	(S)	(D)	(D)	(D)	0	0
Communication equipment	366	117,066	(S)	(D)	(D)	(D)	5,423	94,711
Electronic components	367	55,775	(S)	2,060	14,459	2,929	7,030	18,720
Other electrical equipment	361-64,369	60,958	(S)	4,998	11,751	5,853	14,277	16,620
Transportation equipment	37	411,024	(S)	(S)	17,619	12,326	36,724	335,032
Motor vehicles and motor vehicles equipment	371	227,564	(D)	(D)	12,408	7,911	14,359	186,789
Other transportation equipment	373-75,379	15,524	(S)	(S)	2,608	0	10,358	0
Aircraft and missiles	372,376	167,936	(D)	(D)	2,603	4,415	12,007	148,243

See explanatory information and SOURCE at end of table.

Table A-16. Domestic net sales of R&D-performing companies, by industry, by size of company: 1989-90

[Dollars in millions]

1989

Size of company

Industry	SIC code	Total	Less than 500 employees	500 to 999 employees	1,000 to 4,999 employees	5,000 to 9,999 employees	10,000 to 24,999 employees	25,000 or more employees
Professional and scientific instruments	38	$76,798	(S)	$2,849	$9,282	$6,147	$3,970	$45,552
Scientific and mechanical measuring instruments	381-82	21,847	(S)	800	3,745	2,663	1,659	(D)
Optical, surgical, photographic, and other instruments	383-87	54,951	(S)	2,049	5,537	3,484	2,311	(D)
Other manufacturing industries	27,31,39	38,703	(S)	(S)	13,890	5,300	13,846	0
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	518,336	(S)	(S)	(S)	65,362	106,213	212,766

[Dollars in millions]

1990

Size of company

Industry	SIC code	Total	Less than 500 employees	500 to 999 employees	1,000 to 4,999 employees	5,000 to 9,999 employees	10,000 to 24,999 employees	25,000 or more employees
Total		$2,670,439	(S)	(S)	(S)	$268,639	$479,285	$1,327,867
Food, kindred, and tobacco products	20,21	272,837	(S)	(S)	(S)	27,486	51,763	158,480
Textiles and apparel	22,23	(S)	(S)	(S)	(S)	(D)	16,338	(D)
Lumber, wood products, and furniture	24,25	25,446	(D)	(S)	(S)	5,647	4,765	(D)
Paper and allied products	26	91,328	(S)	(S)	(S)	11,446	31,219	32,792
Chemicals and allied products	28	219,073	(S)	4,929	32,221	20,226	62,839	84,083
Industrial chemicals	281-82,286	94,628	(S)	1,539	9,902	12,926	17,941	51,795
Drugs and medicines	283	57,903	(S)	679	4,824	(D)	30,380	(D)
Other chemicals	284-85,287-89	66,542	(S)	(S)	17,485	(D)	15,448	(D)
Petroleum refining and extraction	13,29	245,549	(S)	(S)	(S)	(S)	45,757	162,247
Rubber products	30	41,763	(D)	(S)	8,838	6,292	7,876	(D)
Stone, clay, and glass products	32	38,211	(S)	(S)	(S)	(D)	13,480	(D)
Primary metals	33	77,879	(S)	(S)	14,786	11,938	14,167	31,772
Ferrous metals and products	331-32,3398-99	41,981	(S)	(S)	(S)	5,787	(D)	(D)
Nonferrous metals and products	333-36	35,898	(S)	(S)	8,005	6,151	(D)	(D)
Fabricated metal products	34	(S)	(D)	(S)	(S)	8,759	10,822	(D)

See explanatory information and SOURCE at end of table.

Table A-16. Domestic net sales of R&D-performing companies, by industry, by size of company: 1989-90

[Dollars in millions]

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			1990 Size of company					
Industry	SIC code	Total	Less than 500 employees	500 to 999 employees	1,000 to 4,999 employees	5,000 to 9,999 employees	10,000 to 24,999 employees	25,000 or more employees
Machinery	35	$164,683	(S)	(S)	$33,850	$25,222	$17,493	$56,204
Office, computing, and accounting machines	357	71,587	(S)	(S)	6,557	13,782	4,793	40,550
Other machinery, except electrical	351-56,358-59	93,096	(S)	(S)	27,293	11,440	12,700	15,654
Electrical equipment	36	239,773	(S)	(S)	24,728	17,639	32,832	129,862
Radio and TV receiving equipment	365	2,943	(S)	(D)	(S)	(D)	0	0
Communication equipment	366	120,650	7,166	1,135	4,055	(S)	10,929	92,442
Electronic components	367	55,324	(D)	(D)	8,090	7,775	7,671	19,630
Other electrical equipment	361-64,369	60,856	(D)	5,604	11,797	(D)	14,232	17,790
Transportation equipment	37	409,877	(S)	(S)	(S)	20,206	33,533	333,544
Motor vehicles and motor vehicles equipment	371	217,442	(D)	(S)	(S)	(D)	13,399	176,833
Other transportation equipment	373-75,379	15,667	(S)	(D)	2,372	(D)	9,154	0
Aircraft and missiles	372,376	176,768	(D)	(D)	2,724	5,663	10,980	156,711
Professional and scientific instruments	38	79,538	(S)	(S)	10,815	4,659	3,807	46,918
Scientific and mechanical measuring instruments	381-82	22,043	(S)	864	4,315	1,723	(D)	(D)
Optical, surgical, photographic, and other instruments	383-87	57,495	(S)	(S)	6,500	2,936	(D)	(D)
Other manufacturing industries	27,31,39	40,619	(D)	(S)	(S)	7,335	12,788	(D)
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	(S)	(S)	(S)	(S)	(S)	120,126	246,843

(D) Data have been withheld to avoid disclosing operations of individual companies.
(S) Data have been withheld due to imputation of 50 percent of more.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-17. Total (company, Federal, and other) R&D funds as a percent of net sales in R&D-performing manufacturing companies, by industry and size of company: 1980-90

[Percent]

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Industry and size of company	SIC code	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Total		3.0 %	3.1 %	3.8 %	3.9 %	3.9 %	4.4 %	4.7 %	4.6 %	4.7 %	4.6 %	4.6 %
Distribution by industry												
Food, kindred, and tobacco products 1/	20,21	0.4	(D)	(D)	(D)	(D)	(D)	(D)	0.6	(D)	(D)	(D)
Textiles and apparel	22,23	0.4	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Lumber, wood products, and furniture	24,25	0.8	0.8	0.8	0.8	0.7	0.8	0.6	0.6	(D)	0.7	0.7
Paper and allied products	26	1.0	(D)	1.1	(D)	(D)	(D)	(D)	(D)	(D)	0.7	0.8
Chemicals and allied products	28	3.6	3.6	4.3	4.4	4.7	5.0	5.2	5.3	5.4	5.4	5.7
Industrial chemicals	281-82,286	3.3	3.2	4.0	3.9	4.0	4.4	4.6	4.7	4.5	4.4	4.6
Drugs and medicines	283	6.2	(D)	(D)	(D)	(D)	(D)	8.5	(D)	9.0	(D)	(D)
Other chemicals	284-85,287-89	1.9	(D)	(D)	(D)	(D)	(D)	3.3	(D)	3.5	(D)	(D)
Petroleum refining and extraction	13,29	0.6	(D)	(D)	(D)	(D)	(D)	(D)	1.0	1.0	1.0	0.9
Rubber products	30	2.2	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Stone, clay, and glass products	32	1.4	(D)	(D)	(D)	(D)	(D)	2.5	2.6	(D)	(D)	(D)
Primary metals	33	0.7	0.9	1.1	1.3	(D)	(D)	(D)	0.9	0.8	0.9	(D)
Ferrous metals and products	331-32,3398-99	0.7	(D)	(D)	(D)	(D)	(D)	(D)	(D)	0.6	(D)	(D)
Nonferrous metals and products	333-36	0.7	(D)	(D)	(D)	1.2	1.4	1.5	(D)	1.1	(D)	(D)
Fabricated metal products	34	1.4	1.4	1.3	1.4	1.5	1.5	1.5	1.5	1.3	1.2	1.2
Machinery	35	5.0	4.9	5.6	6.2	6.4	7.6	(D)	(D)	(D)	8.7	8.9
Office, computing, and accounting machines	357	12.0	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Other machinery, except electrical	351-56,358-59	2.3	(D)	(D)	(D)	(D)	(D)	3.0	3.0	3.2	(D)	(D)
Electrical equipment	36	6.6	6.8	7.2	7.9	6.8	7.6	7.9	8.2	7.8	7.1	7.3
Radio and TV receiving equipment	365	4.3	(D)	(D)	(D)	(D)	(D)	3.6	3.2	3.0	2.8	3.1
Communication equipment	366	9.1	9.6	11.0	11.5	9.8	10.1	9.9	10.2	9.8	8.7	8.1
Electronic components	367	7.9	7.4	6.8	7.7	7.8	9.6	(D)	10.0	9.5	(D)	(D)
Other electrical equipment	361-64,369	4.9	(D)	(D)	(D)	(D)	(D)	(D)	2.7	2.4	(D)	(D)
Transportation equipment	37	N/A	N/A	N/A	N/A	(D)	(D)	8.3	8.7	8.9	9.0	8.8
Motor vehicles and motor vehicles equipment	371	4.9	4.5	4.5	4.0	3.4	3.8	(D)	(D)	(D)	(D)	(D)
Other transportation equipment	373-75,379	0.6	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Aircraft and missiles	372,376	13.7	16.0	17.1	15.2	15.4	14.9	13.4	14.7	15.6	15.3	14.3

See explanatory information and SOURCE at end of table.

Table A-17. Total (company, Federal, and other) R&D funds as a percent of net sales in R&D-performing manufacturing companies, by industry and size of company: 1980-90

[Percent]

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Industry and size of company	SIC code	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Professional and scientific instruments	38	7.5 %	8.1 %	8.4 %	8.6 %	8.3 %	8.9 %	6.8 %	7.9 %	7.5 %	7.5 %	7.7 %
Scientific and mechanical measuring instruments	381-82	8.4	(D)	(D)	(D)	(D)	(D)	(D)	(D)	8.5	8.6	9.5
Optical, surgical, photographic, and other instruments	383-87	6.9	(D)	(D)	(D)	(D)	(D)	(D)	(D)	7.1	7.1	7.1
Other manufacturing industries 1/	27,31,39	0.4	(D)	(D)	(D)	(D)	(D)	1.2	(D)	(D)	(D)	(D)
Distribution by size of company [Based on number of employees]												
Less than 500 2/		1.4	1.5	1.8	2.5	2.9	3.6	4.1	3.9	3.6	3.7	3.7
500 to 999 3/		N/A	N/A	N/A	N/A	2.3	2.4	2.4	2.3	2.2	1.7	2.0
1,000 to 4,999		1.8	1.7	1.9	2.0	2.2	2.6	2.5	2.6	2.5	2.1	2.2
5,000 to 9,999		1.4	2.1	1.7	1.7	1.8	1.9	2.3	2.3	2.3	2.6	2.9
10,000 to 24,999		1.7	1.9	2.4	2.8	3.1	3.1	3.2	3.1	3.1	2.7	3.0
25,000 or more		4.0	4.6	5.4	5.5	5.3	6.2	6.5	6.6	6.6	6.4	6.2

1/ Until 1984, tobacco products, SIC 21, was included with "other manufacturing industries."
2/ Until 1984, data represent companies with less than 1,000 employees.
3/ See footnote #2
(D) Data have been withheld to avoid disclosing operations of individual companies.

N/A Not available

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-18. Company and other (except Federal) R&D funds as a percent of net sales in R&D-performing manufacturing companies, by industry and size of company: 1980-90

[Percent]

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Industry and size of company	SIC code	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Total		2.1 %	2.2 %	2.6 %	2.6 %	2.6 %	3.0 %	3.2 %	3.1 %	3.1 %	3.2 %	3.2 %
Distribution by industry												
Food, kindred, and tobacco products 1/	20,21	(D)	0.4	0.4	0.4	0.4	0.6	0.6	0.6	0.5	0.5	0.5
Textiles and apparel	22,23	(D)	0.4	0.5	0.4	0.5	0.5	0.5	0.4	0.4	0.4	0.4
Lumber, wood products, and furniture	24,25	0.8	0.8	0.8	0.8	0.7	0.8	0.6	0.6	0.7	0.7	0.7
Paper and allied products	26	1.0	1.0	1.1	0.9	0.8	0.8	0.7	0.6	0.7	0.7	0.8
Chemicals and allied products	28	3.3	3.4	4.0	4.2	4.6	4.9	5.1	5.2	5.3	5.3	5.7
Industrial chemicals	281-82,286	2.8	2.8	3.5	3.4	3.8	4.2	4.4	4.4	4.3	4.3	4.5
Drugs and medicines	283	6.1	6.3	7.0	7.7	8.2	8.0	8.4	8.7	9.0	9.1	9.8
Other chemicals	284-85,287-89	1.9	2.1	2.3	2.5	2.9	3.1	3.3	3.3	3.5	3.4	3.9
Petroleum refining and extraction	13,29	0.5	0.6	0.8	0.7	0.7	0.9	1.1	1.0	1.0	1.0	0.8
Rubber products	30	(D)	1.9	1.7	1.7	1.9	1.8	1.7	1.6	1.6	1.7	1.8
Stone, clay, and glass products	32	1.3	1.4	1.7	1.9	1.9	2.3	2.4	2.5	2.2	2.3	2.3
Primary metals	33	0.5	0.7	0.8	0.8	0.9	0.9	1.0	0.9	0.8	0.9	1.0
Ferrous metals and products	331-32,3398-99	0.5	0.6	0.6	0.6	0.6	0.5	0.7	0.6	0.6	0.6	0.6
Nonferrous metals and products	333-36	0.6	1.0	1.3	1.2	1.2	1.4	1.5	1.3	1.1	1.2	1.5
Fabricated metal products	34	1.2	1.2	1.2	1.3	1.4	1.4	1.4	1.2	1.0	1.0	1.0
Machinery	35	4.5	4.4	5.0	5.4	5.8	6.7	7.3	7.1	7.2	8.0	8.4
Office, computing, and accounting machines	357	10.4	9.7	10.4	10.0	10.5	12.4	12.4	12.3	11.5	13.5	15.4
Other machinery, except electrical	351-56,358-59	2.2	2.3	2.4	2.4	2.5	2.6	2.9	3.0	3.1	3.0	3.0
Electrical equipment	36	3.9	4.2	4.4	5.0	4.5	4.8	5.1	5.4	5.3	4.9	4.9
Radio and TV receiving equipment	365	2.7	2.6	3.3	2.9	3.7	4.3	3.6	3.2	3.0	2.8	3.1
Communication equipment	366	5.4	6.0	6.7	7.2	5.1	5.4	5.2	5.5	5.4	5.3	4.9
Electronic components	367	6.9	5.7	5.2	6.6	6.6	8.2	9.2	8.5	8.4	8.0	8.6
Other electrical equipment	361-64,369	2.5	2.8	2.3	2.6	2.2	2.0	2.2	2.6	2.4	2.0	2.2
Transportation equipment	37	N/A	N/A	N/A	N/A	3.3	3.4	3.6	3.4	3.5	3.7	3.7
Motor vehicles and motor vehicles equipment	371	4.2	3.9	4.0	3.5	3.0	3.1	3.3	3.4	3.4	3.8	3.9
Other transportation equipment	373-75,379	0.3	0.3	0.7	1.7	2.0	2.3	2.7	2.5	2.5	2.3	1.9
Aircraft and missiles	372,376	3.8	4.6	5.1	4.1	4.0	3.9	4.0	3.6	3.6	3.6	3.5

See explanatory information and SOURCE at end of table.

Table A-18. Company and other (except Federal) R&D funds as a percent of net sales in R&D-performing manufacturing companies, by industry and size of company: 1980-90

[Percent]

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Industry and size of company	SIC code	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Professional and scientific instruments	38	6.1 %	6.7 %	7.3 %	7.7 %	7.6 %	8.3 %	8.2 %	7.5 %	7.3 %	7.3 %	7.6 %
Scientific and mechanical measuring instruments	381-82	6.2	6.9	7.6	8.8	8.3	8.4	8.4	8.1	8.4	8.5	9.4
Optical, surgical, photographic, and other instruments	383-87	6.0	6.6	7.1	7.1	7.3	8.1	8.0	7.2	6.9	6.9	6.9
Other manufacturing industries 1/	27,31,39	0.4	0.4	0.8	1.0	1.1	1.0	1.2	1.1	1.1	1.0	1.1
Distribution by size of company [Based on number of employees]												
Less than 500 2/		1.2	1.4	1.6	2.2	2.8	3.4	4.0	3.8	3.6	3.6	3.6
500 to 999 3/		N/A	N/A	N/A	N/A	2.2	2.2	2.2	2.2	2.1	1.6	1.8
1,000 to 4,999		1.4	1.5	1.7	2.0	2.0	2.4	2.4	2.4	2.1	2.0	2.1
5,000 to 9,999		1.1	1.7	1.5	1.3	1.6	1.8	2.0	2.0	2.3	2.5	2.7
10,000 to 24,999		1.4	1.6	2.0	2.3	2.5	2.5	2.6	2.5	2.6	2.4	2.7
25,000 or more		2.5	2.7	3.3	3.4	3.2	3.5	3.7	3.8	3.8	3.7	3.8

1/ Until 1984, tobacco products, SIC 21, was included with "other manufacturing industries."
2/ Until 1984, data represent companies with less than 1,000 employees.
3/ See footnote #2
(D) Data have been withheld to avoid disclosing operations of individual companies.

N/A Not available

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-19. Total (company, Federal, and other) R&D funds as a percent of net sales in R&D-performing manufacturing companies ranked by size of R&D program, by industry: 1990

Industry	SIC code	Total R&D funds as a percent of net sales [Percent] First 4 companies	Next 4 companies	Next 12 companies	Total R&D funds [Dollars in millions] First 4 companies	Next 4 companies	Next 12 companies
Total		12.9 %	10.1 %	11.6 %	$19,113	$12,840	$16,639
Food, kindred, and tobacco products	20,21	0.9	1.0	(S)	600	205	312
Textiles and apparel	22,23	(S)	0.4	0.5	(S)	46	41
Lumber, wood products, and furniture	24,25	1.2	(S)	(S)	85	30	37
Paper and allied products	26	1.2	1.7	0.7	336	127	148
Chemicals and allied products	28	7.1	7.4	8.2	3,294	2,030	3,473
Industrial chemicals	281-82,286	6.2	3.1	3.9	2,807	588	725
Drugs and medicines	283	12.0	9.5	9.6	2,302	1,322	1,847
Other chemicals	284-85,287-89	5.1	3.2	2.5	1,216	237	271
Petroleum refining and extraction	13,29	1.5	0.7	0.4	1,311	522	249
Rubber products	30	3.7	2.5	1.7	469	73	108
Stone, clay, and glass products	32	4.6	1.7	1.2	704	119	73
Primary metals	33	1.2	1.1	1.2	353	133	206
Ferrous metals and products	331-32,3398-99	(D)	1.0	1.1	124	53	43
Nonferrous metals and products	333-36	2.5	(S)	0.8	348	110	95
Fabricated metal products	34	4.2	1.5	1.0	350	113	87
Machinery	35	19.7	10.4	9.0	8,192	1,420	1,847
Office, computing, and accounting machines	357	19.7	19.2	9.9	8,192	1,253	1,270
Other machinery, except electrical	351-56,358-59	5.1	7.1	3.8	914	300	406
Electrical equipment	36	11.0	20.1	6.4	7,475	2,687	3,104
Radio and TV receiving equipment	365	(D)	(S)	(S)	70	(S)	(S)
Communication equipment	366	11.1	5.7	5.7	5,527	1,403	832
Electronic components	367	13.8	13.6	12.0	2,997	679	638
Other electrical equipment	361-64,369	(D)	2.5	1.4	(D)	185	244
Transportation equipment	37	10.9	10.5	8.9	17,097	9,525	6,136
Motor vehicles and motor vehicles equipment	371	(D)	2.1	0.7	(D)	157	110
Other transportation equipment	373-75,379	3.2	1.4	(S)	333	21	(S)
Aircraft and missiles	372,376	21.1	11.4	11.3	13,747	6,880	4,483

See explanatory information and SOURCE at end of table.

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Table A-19. Total (company, Federal, and other) R&D funds as a percent of net sales in R&D-performing manufacturing companies ranked by size of R&D program, by industry: 1990

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Industry	SIC code	Total R&D funds as a percent of net sales [Percent] First 4 companies	Total R&D funds as a percent of net sales [Percent] Next 4 companies	Total R&D funds as a percent of net sales [Percent] Next 12 companies	Total R&D funds [Dollars in millions] First 4 companies	Total R&D funds [Dollars in millions] Next 4 companies	Total R&D funds [Dollars in millions] Next 12 companies
Professional and scientific instruments...........	38	9.5 %	6.6 %	9.4 %	$3,881	$653	$538
Scientific and mechanical measuring instrum	381-82	(D)	12.5	4.8	(D)	85	132
Optical, surgical, photographic, and other instruments..	383-87	7.5	11.7	7.1	2,862	459	337
Other manufacturing industries......................	27,31,39	2.6	1.9	1.7	180	101	90

(D) Data have been withheld to avoid disclosing operations of individual companies.
(S) Data have been withheld due to imputation of more than 50 percent.

NOTE: Rankings were based on total (company, Federal, and other) R&D funds.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-20. Company and other (except Federal) R&D funds as a percent of net sales in R&D-performing manufacturing companies ranked by size of company-financed R&D program, by industry: 1990

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		Company and other R&D funds as a percent of net sales [Percent]			Company and other R&D funds [Dollars in millions]		
Industry	SIC code	First 4 companies	Next 4 companies	Next 12 companies	First 4 companies	Next 4 companies	Next 12 companies
Total		7.0 %	6.9 %	6.4 %	$14,816	$5,106	$9,722
Food, kindred, and tobacco products	20,21	0.9	1.0	(S)	599	205	312
Textiles and apparel	22,23	(S)	0.4	0.5	(S)	46	40
Lumber, wood products, and furniture	24,25	1.2	(S)	(S)	85	(S)	(S)
Paper and allied products	26	1.2	1.7	0.7	336	127	148
Chemicals and allied products	28	7.1	7.4	8.2	3,286	2,030	3,469
Industrial chemicals	281-82,286	6.1	3.1	3.7	2,798	585	685
Drugs and medicines	283	(S)	9.5	9.4	(S)	1,321	1,828
Other chemicals	284-85,287-89	5.1	3.2	2.5	1,216	237	271
Petroleum refining and extraction	13,29	1.5	0.7	0.4	1,310	520	239
Rubber products	30	3.7	1.8	1.8	469	72	99
Stone, clay, and glass products	32	4.4	1.6	1.2	670	119	73
Primary metals	33	1.2	(S)	1.1	332	(S)	189
Ferrous metals and products	331-32,3398-99	(D)	1.0	1.0	124	53	42
Nonferrous metals and products	333-36	2.3	(S)	0.7	327	(S)	85
Fabricated metal products	34	3.2	1.1	1.0	249	91	80
Machinery	35	17.9	10.3	8.0	7,470	1,409	1,813
Office, computing, and accounting machines	357	17.9	19.2	9.6	7,470	1,253	1,232
Other machinery, except electrical	351-56,358-59	4.9	6.5	3.6	889	262	359
Electrical equipment	36	9.1	3.8	4.8	4,796	1,244	2,068
Radio and TV receiving equipment	365	(D)	(S)	(S)	70	(S)	(S)
Communication equipment	366	5.5	4.8	4.3	3,566	783	459
Electronic components	367	11.2	14.0	9.4	2,441	679	517
Other electrical equipment	361-64,369	2.9	2.5	1.4	584	185	243
Transportation equipment	37	4.6	3.8	3.1	9,672	2,619	1,955
Motor vehicles and motor vehicles equipment	371	4.5	2.1	(S)	8,223	157	(S)
Other transportation equipment	373-75,379	2.9	0.6	(S)	261	15	(S)
Aircraft and missiles	372,376	3.9	4.2	2.4	3,670	1,526	792

See explanatory information and SOURCE at end of table.

Table A-20. Company and other (except Federal) R&D funds as a percent of net sales in R&D-performing manufacturing companies ranked by size of company-financed R&D program, by industry: 1990

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Industry	SIC code	Company and other R&D funds as a percent of net sales [Percent] First 4 companies	Next 4 companies	Next 12 companies	Company and other R&D funds [Dollars in millions] First 4 companies	Next 4 companies	Next 12 companies
Professional and scientific instruments................	38	9.3 %	6.6 %	9.4 %	$3,804	$648	$538
Scientific and mechanical measuring instruments..	381-82	(D)	12.5	4.8	(D)	$85	132
Optical, surgical, photographic, and other instruments..	383-87	7.3	11.7	7.1	2,785	458	337
Other manufacturing industries............................	27,31,39	2.6	1.9	1.7	180	101	90

(D) Data have been withheld to avoid disclosing operations of individual companies.
(S) Data have been withheld due to imputation of 50 percent or more.

NOTE: Rankings were based on company and other (except Federal) R&D funds.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-21. Federal R&D funds as a percent of net sales in R&D-performing manufacturing companies ranked by size of Federal R&D program, by industry: 1990

Industry	SIC code	Federal R&D funds as a percent of net sales [Percent]			Federal R&D funds [Dollars in millions]		
		First 4 companies	Next 4 companies	Next 12 companies	First 4 companies	Next 4 companies	Next 12 companies
Total		17.8 %	5.6 %	3.3 %	$11,588	$4,857	$7,974
Food, kindred, and tobacco products	20,21	(D)	0.0	0.0	(D)	0	0
Textiles and apparel	22,23	(D)	0.0	0.0	(D)	0	0
Lumber, wood products, and furniture	24,25	0.0	0.0	0.0	0	0	0
Paper and allied products	26	0.0	0.0	0.0	0	0	0
Chemicals and allied products	28	0.2	0.1	1/	52	8	6
Industrial chemicals	281-82,286	0.2	0.1	1/	52	8	3
Drugs and medicines	283	1/	(D)	0.0	3	(D)	0
Other chemicals	284-85,287-89	(D)	0.0	0.0	(D)	0	0
Petroleum refining and extraction	13,29	(S)	(D)	0.0	(S)	1	0
Rubber products	30	(D)	0.0	0.0	(D)	0	0
Stone, clay, and glass products	32	(D)	0.0	0.0	(D)	0	0
Primary metals	33	(D)	(S)	0.0	(D)	(S)	(D)
Ferrous metals and products	331-32,3398-99	(D)	0.0	0.0	(D)	0	0
Nonferrous metals and products	333-36	(D)	(D)	0.0	(D)	(D)	0
Fabricated metal products	34	1.5	(D)	0.0	123	(D)	0
Machinery	35	(D)	0.4	0.3	(D)	52	10
Office, computing, and accounting machines	357	(D)	(D)	0.0	(D)	(D)	0
Other machinery, except electrical	351-56,358-59	1.1	(D)	(D)	121	(D)	2/
Electrical equipment	36	5.9	5.0	2.6	3,776	979	732
Radio and TV receiving equipment	365	0.0	0.0	0.0	0	0	0
Communication equipment	366	5.0	2.4	3.1	2,695	526	195
Electronic components	367	3.1	4.5	0.4	616	81	14
Other electrical equipment	361-64,369	(D)	(S)	(D)	(D)	(S)	(D)
Transportation equipment	37	17.8	3.1	4.6	11,588	4,424	4,766
Motor vehicles and motor vehicles equipment	371	(D)	0.0	0.0	(D)	0	0
Other transportation equipment	373-75,379	1.1	0.0	0.0	79	0	0
Aircraft and missiles	372,376	17.8	9.0	6.5	11,588	4,327	3,269

See explanatory information and SOURCE at end of table.

Table A-21. Federal R&D funds as a percent of net sales in R&D-performing manufacturing companies ranked by size of Federal R&D program, by industry: 1990

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Industry	SIC code	Federal R&D funds as a percent of net sales [Percent]			Federal R&D funds [Dollars in millions]		
		First 4 companies	Next 4 companies	Next 12 companies	First 4 companies	Next 4 companies	Next 12 companies
Professional and scientific instruments	38	(D)	(D)	(D)	(D)	8	(D)
Scientific and mechanical measuring instruments	381-82	(D)	(D)	0.0	(D)	(D)	0
Optical, surgical, photographic, and other instruments	383-87	(D)	0.3	0.0	(D)	4	0
Other manufacturing industries	27,31,39	(D)	0.0	0.0	(D)	0	0

1/ Less than 0.05 percent
2/ Less than $0.5 million
(D) Data have been withheld to avoid disclosing operations of individual companies.
(S) Data have been withheld due to imputation of 50 percent or more.

NOTE: Rankings were based upon Federal R&D funds.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-22. Total (company, Federal, and other) funds for basic research, applied research, and development performance, in current and in 1987 constant dollars: 1953-90

[Dollars in millions]

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Year	Total		Basic research		Applied research		Development	
	Current dollars	Constant dollars	Current dollars	Constant dollars	Current dollars	Constant dollars	Current dollars	Constant dollars
1953 1/	$3,630	N/A	$151	N/A	$726	N/A	$2,753	N/A
1954 1/	4,070	N/A	166	N/A	814	N/A	3,090	N/A
1955 1/	4,640	N/A	189	N/A	928	N/A	3,523	N/A
1956	6,605	N/A	253	N/A	1,268	N/A	5,084	N/A
1957	7,731	N/A	271	N/A	1,670	N/A	5,790	N/A
1958	8,389	N/A	295	N/A	1,911	N/A	6,183	N/A
1959	9,618	$37,585	320	$1,250	1,991	$7,780	7,307	$28,554
1960	10,509	40,388	376	1,445	2,029	7,798	8,104	31,145
1961	10,908	41,554	395	1,505	1,977	7,531	8,537	32,522
1962	11,464	42,712	488	1,818	2,449	9,124	8,527	31,770
1963	12,630	46,451	522	1,920	2,457	9,036	9,651	35,495
1964	13,512	48,868	549	1,986	2,600	9,403	10,363	37,479
1965	14,185	49,930	592	2,084	2,658	9,356	10,935	38,490
1966	15,548	52,974	624	2,126	2,843	9,687	12,081	41,162
1967	16,355	54,130	629	2,078	2,915	9,630	12,841	42,422
1968	17,429	54,894	642	2,022	3,124	9,839	13,663	43,033
1969	18,308	54,897	618	1,853	3,287	9,856	14,403	43,187
1970	18,067	51,429	602	1,714	3,427	9,755	14,038	39,960
1971	18,320	49,527	590	1,595	3,415	9,232	14,315	38,700
1972	19,552	50,353	593	1,527	3,514	9,050	15,445	39,776
1973	21,249	51,488	631	1,529	3,825	9,268	16,793	40,691
1974	22,887	50,996	699	1,557	4,288	9,554	17,900	39,884
1975	24,187	49,171	730	1,484	4,570	9,291	18,887	38,396
1976	26,997	51,649	819	1,567	5,112	9,780	21,066	40,302
1977	29,825	53,383	911	1,631	5,636	10,088	23,278	41,665
1978 1/	33,304	55,240	1,035	1,717	6,300	10,449	25,969	43,073
1979	38,226	58,316	1,158	1,767	7,225	11,022	29,843	45,527
1980 1/	44,505	62,062	1,325	1,848	8,450	11,784	34,730	48,431
1981	51,810	65,699	1,614	2,047	10,699	13,567	39,497	50,085
1982 1/	58,650	70,021	1,904	2,273	12,323	14,712	44,423	53,036
1983	65,268	74,883	2,223	2,550	13,927	15,979	49,118	56,354
1984	74,800	82,153	2,608	2,864	15,765	17,315	56,427	61,974
1985	84,239	89,265	2,862	3,033	18,255	19,344	63,122	66,888
1986	87,823	90,614	4,047	4,176	19,759	20,387	64,031	66,066
1987	92,155	92,155	4,324	4,324	19,813	19,813	68,016	68,016
1988	97,889	94,260	4,279	4,120	20,595	19,831	73,015	70,308
1989	101,854	93,944	5,279	4,869	22,305	20,573	74,273	68,505
1990	104,344	92,446	4,364	3,866	23,700	20,998	76,281	67,583

1/ Character-of-work estimates were made by the National Science Foundation. See: National Science Foundation, "National Patterns of R&D Resources: 1990", Final Report, NSF 90-316.

NOTES: The character-of-work estimation procedure was revised for 1986 and later years; hence, these data are not directly comparable with data for 1985 and earlier years. See technical notes for a more complete discussion of this change.

The 1987 GDP implicit price deflator was used to convert current dollars to constant dollars.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-23. Funds for basic research, applied research, and development by industry, by source of funds: 1988

[Dollars in millions]

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Distribution by industry	SIC code	Total			Basic			Applied			Development		
		Total	Federal	Company	Total	Federal	Company	Total	Federal	Company	Total	Federal	Company
Total		$97,889	$32,117	$65,772	$4,279	$908	$3,372	$20,595	$4,338	$16,257	$73,015	$26,871	$46,143
Food, kindred, and tobacco products	20,21	(D)	(D)	1,192	(D)	0	(D)	(D)	0	(D)	(D)	(D)	723
Textiles and apparel	22,23	(D)	(D)	210	(D)	0	(D)	(D)	0	(D)	(D)	(D)	174
Lumber, wood products, and furniture	24,25	(D)	(D)	156	(D)	(D)	(S)	50	0	50	(D)	(D)	82
Paper and allied products	26	(D)	(D)	664	51	0	51	(D)	(D)	237	375	0	375
Chemicals and allied products	28	10,772	199	10,573	810	12	798	4,239	108	4,131	5,724	80	5,644
Industrial chemicals	281-82,286	3,959	196	3,763	297	12	285	(D)	(D)	1,452	(D)	(D)	2,026
Drugs and medicines	283	4,746	3	4,743	(S)	0	(S)	(D)	(D)	1,948	(D)	(D)	2,316
Other chemicals	284-85,287-89	2,067	0	2,067	34	0	34	731	0	731	1,302	0	1,302
Petroleum refining and extraction	13,29	1,944	21	1,923	(D)	(D)	76	(D)	(D)	987	873	13	860
Rubber products	30	(D)	(D)	635	58	0	58	(D)	(D)	130	(D)	(D)	447
Stone, clay, and glass products	32	(D)	(D)	826	163	0	163	(D)	(D)	(S)	229	0	229
Primary metals	33	663	21	642	79	0	79	(D)	(D)	228	(D)	(D)	335
Ferrous metals and products	331-32,3398-99	258	1	257	4	0	4	(D)	(D)	127	(D)	(D)	127
Nonferrous metals and products	333-36	405	20	385	75	0	75	(D)	(D)	101	(D)	(D)	209
Fabricated metal products	34	829	142	687	55	0	55	(D)	(D)	161	(D)	(D)	471
Machinery	35	(D)	(D)	11,992	(D)	(D)	244	(D)	(D)	2,054	(D)	(D)	9,694
Office, computing, and accounting machines	357	(D)	(D)	9,371	(D)	(D)	164	(D)	(D)	1,583	(D)	(D)	7,624
Other machinery, except electrical	351-56,358-59	2,719	98	2,621	(S)	0	(S)	(D)	(D)	471	(D)	(D)	2,070
Electrical equipment	36	16,242	5,181	11,061	627	26	601	3,754	803	2,950	11,861	4,351	7,509
Radio and TV receiving equipment	365	139	0	139	(D)	0	(D)	(D)	0	(D)	(D)	0	(D)
Communication equipment	366	10,296	4,621	5,675	(D)	(D)	(D)	(D)	(D)	800	8,585	(D)	(D)
Electronic components	367	4,607	539	4,068	(D)	(D)	(D)	2,094	(D)	(D)	(D)	(D)	2,021
Other electrical equipment	361-64,369	1,200	21	1,179	(S)	0	(S)	207	0	207	846	21	825
Transportation equipment	37	36,338	22,176	14,162	477	263	215	3,922	2,069	1,853	31,940	19,846	12,094
Motor vehicles and motor vehicles equipment	371	(D)	(D)	7,769	101	0	101	(D)	(D)	(D)	(D)	(D)	(D)
Other transportation equipment	373-75,379	(D)	(D)	370	(S)	0	(S)	(D)	(D)	(D)	(D)	(D)	(D)
Aircraft and missiles	372,376	25,900	19,877	6,023	366	263	104	2,997	1,915	1,082	22,537	17,700	4,838

See explanatory information and SOURCE at end of table.

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Table A-23. Funds for basic research, applied research, and development by industry, by source of funds: 1988

[Dollars in millions]

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Distribution by industry	SIC code	Total Total	 Federal	 Company	Basic Total	 Federal	 Company	Applied Total	 Federal	 Company	Development Total	 Federal	 Company
Professional and scientific instruments	38	$5,426	$120	$5,306	(D)	(D)	$486	(D)	(D)	$1,135	$3,775	$91	$3,685
Scientific and mechanical measuring instruments	381-82	1,734	(S)	1,710	$160	$0	160	(D)	(D)	283	(D)	(D)	1,268
Optical, surgical, photographic, and other instruments	383-87	3,692	96	3,596	(D)	(D)	327	(D)	(D)	852	(D)	(D)	2,417
Other manufacturing industries	27,31,39	(D)	(D)	383	(S)	0	(S)	$53	$0	53	274	0	274
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	8,113	2,753	5,360	1,001	594	407	2,222	815	1,406	4,890	1,344	3,546

(D) Data have been withheld to avoid disclosing operations of individual companies.
(S) Data have been withheld due to imputation of more than 50 percent.

NOTE: The character-of-work estimation procedure was revised for 1986 and later years; hence, these data are not directly comparable with data for 1985 and earlier years.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-24. Funds for basic research, applied research, and development by industry, by source of funds: 1989

[Dollars in millions]

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Distribution by industry	SIC code	Total			Basic			Applied			Development		
		Total	Federal	Company	Total	Federal	Company	Total	Federal	Company	Total	Federal	Company
Total		$101,854	$31,292	$70,562	$5,279	$1,253	$4,027	$22,305	$4,950	$17,355	$74,273	$25,094	$49,179
Food, kindred, and tobacco products	20,21	(D)	(D)	1,284	31	0	31	(D)	(D)	473	(D)	(D)	780
Textiles and apparel	22,23	(D)	(D)	213	(D)	0	(D)	(D)	0	(D)	(D)	(D)	162
Lumber, wood products, and furniture	24,25	172	0	172	(D)	0	(D)	(D)	0	(D)	84	0	84
Paper and allied products	26	686	0	686	46	0	46	194	0	194	446	0	446
Chemicals and allied products	28	11,466	83	11,383	819	13	806	4,581	12	4,568	6,066	57	6,009
Industrial chemicals	281-82,286	4,039	79	3,960	336	13	323	(D)	(D)	1,536	(D)	(D)	2,101
Drugs and medicines	283	(D)	(D)	5,164	(S)	0	(S)	(D)	(D)	2,163	(D)	(D)	2,563
Other chemicals	284-85,287-89	(D)	(D)	2,259	45	0	45	(D)	(D)	869	(D)	(D)	1,344
Petroleum refining and extraction	13,29	2,066	(S)	2,050	(D)	(D)	104	(D)	(D)	973	982	10	972
Rubber products	30	(D)	(D)	678	50	0	50	(D)	(D)	130	(D)	(D)	497
Stone, clay, and glass products	32	(D)	(D)	864	(D)	(D)	183	(D)	(D)	423	(D)	(D)	257
Primary metals	33	749	34	715	89	0	89	(D)	(D)	243	(D)	(D)	383
Ferrous metals and products	331-32,3398-99	(D)	(D)	254	(D)	0	(D)	(D)	(D)	(D)	(D)	(D)	130
Nonferrous metals and products	333-36	(D)	(D)	461	(D)	0	(D)	(D)	(D)	(D)	(D)	(D)	253
Fabricated metal products	34	800	136	664	45	0	45	(D)	(D)	177	(D)	(D)	441
Machinery	35	14,635	1,157	13,478	(D)	(D)	257	(D)	(D)	2,687	(D)	(D)	(S)
Office, computing, and accounting machines	357	(D)	(D)	10,780	(D)	(D)	169	(D)	(D)	2,203	(D)	(D)	(S)
Other machinery, except electrical	351-56,358-59	(D)	(D)	2,698	87	0	87	(D)	(D)	484	2,206	80	2,126
Electrical equipment	36	16,929	5,288	11,641	512	30	483	4,218	(S)	2,901	12,201	3,944	8,257
Radio and TV receiving equipment	365	84	0	84	(D)	0	(D)	13	0	13	(D)	0	(D)
Communication equipment	366	10,539	4,719	5,820	(D)	(D)	(D)	(D)	(D)	(D)	8,447	[illegible]	4,896
Electronic components	367	(D)	(D)	4,458	(D)	(D)	56	(D)	(D)	2,010	(D)	[illegible]	2,393
Other electrical equipment	361-64,369	(D)	(D)	1,279	(S)	0	(S)	(D)	0	(D)	960	(D)	(D)
Transportation equipment	37	36,844	21,761	15,083	749	537	211	(D)	(D)	1,852	(D)	(D)	13,020
Motor vehicles and motor vehicles equipment	371	(D)	(D)	8,725	(D)	0	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Other transportation equipment	373-75,379	(D)	(D)	353	(D)	0	(D)	(D)	0	(D)	(D)	(D)	(D)
Aircraft and missiles	372,376	25,638	19,633	6,005	653	537	116	3,065	2,107	957	21,921	16,909	4,932

See explanatory information and SOURCE at end of table.

Table A-24. Funds for basic research, applied research, and development by industry, by source of funds: 1989

[Dollars in millions]

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Distribution by industry	SIC code	Total			Basic			Applied			Development		
		Total	Federal	Company	Total	Federal	Company	Total	Federal	Company	Total	Federal	Company
Professional and scientific instruments	38	5,743	113	5,630	(D)	(D)	426	1,464	27	1,437	(D)	(D)	3,767
Scientific and mechanical measuring instruments	381-82	1,868	(S)	1,858	(S)	0	(S)	(D)	(D)	549	1,201	0	1,201
Optical, surgical, photographic, and other instruments	383-87	3,875	103	3,772	(D)	(D)	318	(D)	(D)	888	(D)	(D)	2,566
Other manufacturing industries	27,31,39	(D)	(D)	400	(S)	0	(S)	57	0	57	276	0	276
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	8,286	2,666	5,620	1,832	652	1,180	2,001	856	1,146	4,452	1,158	3,294

(D) Data have been withheld to avoid disclosing operations of individual companies.
(S) Data have been withheld due to imputation of more than 50 percent.

NOTE: The character-of-work estimation procedure was revised for 1986 and later years; hence, these data are not directly comparable with data for 1985 and earlier years.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-25. Funds for basic research, applied research, and development by industry, by source of funds: 1990

[Dollars in millions]

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Distribution by industry	SIC code	Total			Basic			Applied			Development		
		Total	Federal	Company	Total	Federal	Company	Total	Federal	Company	Total	Federal	Company
Total		$104,344	$30,580	$73,764	$4,364	$1,182	$3,182	$23,700	$5,153	$18,547	$76,281	$24,248	$52,033
Food, kindred, and tobacco products	20,21	(D)	(D)	1,376	44	0	44	517	0	517	816	1	815
Textiles and apparel	22,23	(D)	(D)	227	(D)	0	(D)	(S)	0	(S)	(D)	(D)	(D)
Lumber, wood products, and furniture	24,25	180	0	180	(D)	0	(D)	(D)	0	(D)	96	0	96
Paper and allied products	26	736	0	736	30	0	30	191	0	191	515	0	515
Chemicals and allied products	28	12,565	67	12,498	788	(S)	781	5,291	11	5,280	6,486	49	6,437
Industrial chemicals	281-82,286	4,344	64	4,280	303	–(S)	296	(D)	(D)	1,835	(D)	(D)	2,148
Drugs and medicines	283	(D)	(D)	5,851	(S)	0	(S)	(D)	(D)	2,430	(D)	(D)	2,778
Other chemicals	284-85,287-89	(D)	(D)	2,567	50	0	50	(D)	(D)	(S)	1,511	0	1,511
Petroleum refining and extraction	13,29	2,089	(S)	2,083	(D)	(D)	118	949	4	945	(D)	(D)	1,020
Rubber products	30	(D)	(D)	732	(S)	0	(S)	(D)	(D)	217	(D)	(D)	440
Stone, clay, and glass products	32	(D)	(D)	893	(D)	(D)	201	(D)	(D)	430	(D)	(D)	262
Primary metals	33	(D)	(D)	774	(S)	0	(S)	(D)	(D)	(D)	(D)	(D)	(D)
Ferrous metals and products	331-32,3398-99	(D)	(D)	240	(D)	0	(D)	(D)	(D)	(D)	(D)	(D)	111
Nonferrous metals and products	333-36	(D)	(D)	534	(D)	0	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Fabricated metal products	34	808	133	675	34	0	34	(D)	(D)	179	(D)	(D)	461
Machinery	35	14,700	896	13,804	(D)	(D)	233	(D)	(D)	2,426	(D)	(D)	11,145
Office, computing, and accounting machines	357	(D)	(D)	11,050	(D)	(D)	175	(D)	(D)	1,949	(D)	(D)	8,927
Other machinery, except electrical	351-56,358-59	(D)	(D)	2,754	(S)	0	(S)	(D)	(D)	478	(D)	(D)	2,218
Electrical equipment	36	17,397	5,629	11,768	458	25	433	4,808	1,743	3,065	12,131	3,861	8,270
Radio and TV receiving equipment	365	93	0	93	(D)	0	(D)	(D)	0	(D)	(S)	0	(S)
Communication equipment	366	10,373	4,839	5,534	(D)	(D)	(D)	(D)	(D)	(D)	7,777	3,292	4,485
Electronic components	367	(D)	(D)	4,747	(D)	(D)	85	(D)	(D)	1,953	(D)	(D)	2,709
Other electrical equipment	361-64,369	(D)	(D)	1,594	59	0	59	334	0	334	(D)	(D)	1,000
Transportation equipment	37	35,900	20,908	14,992	760	506	254	(D)	(D)	2,151	(D)	(D)	12,587
Motor vehicles and motor vehicles equipment	371	(D)	(D)	8,5[illegible]	(D)	0	(D)	(D)	(D)	652	(D)	(D)	(D)
Other transportation equipment	373-75,379	(D)	(D)	[illegible]	(D)	0	(D)	(S)	0	(S)	270	(D)	(D)
Aircraft and missiles	372,376	25,357	19,2[illegible]	[illegible]	645	506	139	3,322	1,926	1,394	21,380	16,783	4,607

See explanatory information and SOURCE at end of table.

Table A-25. Funds for basic research, applied research, and development by industry, by source of funds: 1990

[Dollars in millions]

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Distribution by industry	SIC code	Total			Basic			Applied			Development		
		Total	Federal	Company	Total	Federal	Company	Total	Federal	Company	Total	Federal	Company
Professional and scientific instruments....................	38	$6,163	$99	$6,064	(D)	(D)	384	1,302	22	1,280	(D)	(D)	4,400
Scientific and mechanical measuring instruments..	381-82	2,086	10	2,076	(D)	(D)	90	(D)	(D)	399	(D)	(D)	1,587
Optical, surgical, photographic, and other instruments...	383-87	4,077	89	3,988	(D)	(D)	294	(D)	(D)	881	(D)	(D)	2,813
Other manufacturing industries................................	27,31,39	(D)	(D)	445	54	0	54	(D)	(D)	88	(D)	(D)	302
Nonmanufacturing industries..................................	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	9,258	2,743	6,515	1,038	631	407	2,196	810	1,386	6,025	1,303	4,722

(D) Data have been withheld to avoid disclosing operations of individual companies.
(S) Data have been withheld due to imputation of more than 50 percent.

NOTE: The character-of-work estimation procedure was revised for 1986 and later years; hence, these data are not directly comparable with data for 1985 and earlier years.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-26. Number of R&D-performing companies conducting basic research, by industry, by size of company: 1990

Size of Company

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Industry	SIC code	Less than 500 employees		500 to 999 employees		1,000 to 4,999 employees		5,000 to 9,999 employees		10,000 to 24,999 employees		25,000 or more employees	
		R&D	Basic research	R&D	Basic research	R&D	Basic research	R&D	Basic research	R&D	Basic research	R&D	Basic research
Total		22,280	126	751	36	999	98	200	34	169	53	132	40
Food, kindred, and tobacco products	20,21	8	0	34	2	46	3	16	4	14	3	14	4
Textiles and apparel	22,23	286	0	108	0	43	0	7	2	11	1	2	1
Lumber, wood products, and furniture	24,25	79	1	28	1	32	1	9	0	3	1	1	0
Paper and allied products	26	256	0	13	1	32	3	11	0	9	1	4	0
Chemicals and allied products	28	2,326	3	33	7	58	19	15	6	20	10	10	4
Industrial chemicals	281-82,286	204	1	9	2	19	7	8	4	5	2	5	3
Drugs and medicines	283	407	1	6	1	8	2	2	1	9	6	4	1
Other chemicals	284-85,287-89	1,715	1	18	4	31	10	5	1	6	2	1	0
Petroleum refining	29	104	0	4	0	10	2	5	0	4	4	7	4
Rubber products	30	308	1	36	2	129	2	6	1	4	1	2	1
Stone, clay, and glass products	32	88	0	25	0	30	4	3	1	6	5	2	1
Primary metals	33	169	1	22	0	41	3	10	2	5	3	3	2
Ferrous metals and products	331-32,3398-99	79	0	10	0	22	2	6	0	1	0	2	1
Nonferrous metals and products	333-36	90	1	12	0	19	1	4	2	4	3	1	1
Fabricated metal products	34	1,796	1	71	1	58	4	9	1	6	1	1	0
Machinery	35	2,539	12	89	6	120	6	26	3	10	2	7	1
Office, computing, and accounting machines	357	438	6	17	2	27	2	10	0	3	1	4	1
Other machinery, except electrical	351-56,358-59	2,101	6	72	4	93	4	16	3	7	1	3	0
Electrical equipment	36	3,414	19	101	3	107	15	17	5	15	2	16	5
Radio and TV receiving equipment	365	172	1	3	0	3	1	1	0	0	0	0	0
Communication equipment	366	614	4	15	1	17	4	4	1	5	0	8	2
Electronic components	367	1,258	14	32	1	35	3	7	3	4	0	3	1
Other electrical equipment	361-64,369	1,370	0	51	1	52	7	5	1	6	2	5	2
Transportation equipment	37	156	4	28	2	40	4	12	4	16	6	18	8
Motor vehicles and motor vehicles equipment	371	100	0	21	1	22	1	6	2	6	1	4	1
Other transportation equipment	373-75,379	53	4	2	0	7	1	1	0	4	2	0	0
Aircraft and missiles	372,376	3	0	5	1	11	2	5	2	6	3	14	7

See explanatory information and SOURCE at end of table.

Table A-26. Number of R&D-performing companies conducting basic research, by industry, by size of company: 1990

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Industry	SIC code	Size of Company Less than 500 employees R&D	Less than 500 employees Basic research	500 to 999 employees R&D	500 to 999 employees Basic research	1,000 to 4,999 employees R&D	1,000 to 4,999 employees Basic research	5,000 to 9,999 employees R&D	5,000 to 9,999 employees Basic research	10,000 to 24,999 employees R&D	10,000 to 24,999 employees Basic research	25,000 or more employees R&D	25,000 or more employees Basic research
Professional and scientific instruments....	38	1,778	18	36	3	43	7	7	2	3	2	5	1
Scientific and mechanical measuring instruments...	381-82	954	10	14	0	19	2	3	0	1	0	1	0
Optical, surgical, photographic, and other instruments................................	383-87	824	8	22	3	24	5	4	2	2	2	4	1
Other manufacturing industries................	27,31,39	309	0	35	1	36	5	8	1	7	2	2	1
Nonmanufacturing industries..................	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	8,664	66	88	7	174	20	39	2	36	9	38	7

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-27. Total (company, Federal, and other) funds for industrial energy R&D performance, by industry: 1980-90, and projected 1991

[Dollars in millions]

Industry	SIC code	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Projected 1991
Total		$4,162	$4,216	$4,240	$4,345	$4,446	$3,954	$3,358	$3,576	$3,738	$3,536	$3,739	$3,904
Food, kindred, and tobacco products 1/	20,21	4	5	(T)	(T)	(S)	2	2	(S)	2/	(D)	(D)	(D)
Textiles and apparel	22,23	(T)	(T)	(T)	(T)	2	1	(D)	(D)	(D)	(D)	(D)	(D)
Lumber, wood products, and furniture	24,25	3	4	5	5	5	3	(D)	(D)	(D)	(D)	(D)	(D)
Paper and allied products	26	3	2	3	3	6	(D)	(D)	1	1	(D)	(D)	(D)
Chemicals and allied products	28	257	312	347	345	191	162	(S)	(S)	(S)	130	159	181
Industrial chemicals	281-82,286	246	305	338	335	181	(D)	(D)	(D)	(D)	128	157	179
Drugs and medicines	283	(T)	(T)	(T)	(T)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Other chemicals	284-85,287-89	(T)	(T)	(T)	(T)	(D)	2	2	2	4	(D)	(D)	(D)
Petroleum refining and extraction	13,29	845	1,067	1,162	1,284	1,356	1,199	999	914	989	989	966	1,018
Rubber products	30	15	17	14	17	16	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Stone, clay, and glass products	32	21	24	17	7	5	(D)	(D)	1	(D)	1	(D)	1
Primary metals	33	78	80	101	92	(S)	(S)	74	18	21	(D)	(D)	25
Ferrous metals and products	331-32,3398-99	20	20	22	35	35	26	(D)	(D)	(D)	(D)	(D)	(D)
Nonferrous metals and products	333-36	58	59	79	57	(S)	(S)	(D)	(D)	(D)	(D)	(D)	(D)
Fabricated metal products	34	(T)	(T)	54	31	(D)	8	(D)	(D)	(D)	14	49	(S)
Machinery	35	108	127	183	163	201	240	261	(D)	230	253	235	253
Office, computing, and accounting machines	357	17	6	16	(T)	(S)	12	(D)	(D)	(D)	(D)	0	0
Other machinery, except electrical	351-56,358-59	91	121	167	144	179	228	(D)	(D)	(D)	(D)	235	253
Electrical equipment	36	917	908	831	813	752	733	(D)	578	744	762	820	863
Radio and TV receiving equipment	365	3	(T)	5	0	0	0	0	0	0	0	0	0
Communication equipment	366	(T)	(T)	155	150	(D)	115	(D)	(D)	(D)	(D)	(D)	(D)
Electronic components	367	12	15	40	82	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Other electrical equipment	361-64,369	(T)	(T)	631	581	618	(D)	(D)	(S)	(D)	(D)	(D)	(D)
Transportation equipment	37	(T)	(T)	(T)	(T)	(D)	(S)	(S)	(S)	(D)	847	863	(D)
Motor vehicles and motor vehicles equipment	371	(T)	(T)	(T)	(T)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Other transportation equipment	373-75,379	(T)	(T)	2	2	1	(D)	(D)	(D)	(D)	(D)	(D)	0
Aircraft and missiles	372,376	446	412	363	425	661	681	537	754	726	614	740	864

See explanatory information and SOURCE at end of table.

Table A-27. Total (company, Federal, and other) funds for industrial energy R&D performance, by industry: 1980-90, and projected 1991

[Dollars in millions]

Industry	SIC code	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Projected 1991
Professional and scientific instruments	38	$45	$53	$54	$45	$36	(D)	(D)	$17	$16	$12	$11	$9
Scientific and mechanical measuring instruments	381-82	40	(T)	(T)	(T)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Optical, surgical, photographic, and other instruments	383-87	5	(T)	(T)	(T)	(T)	(D)	0	(D)	(D)	(D)	(D)	(D)
Other manufacturing industries 1/	27,31,39	19	(T)	12	17	12	0	0	0	0	(D)	(D)	(D)
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	333	374	375	349	424	338	328	433	469	496	599	557

1/ Until 1984, tobacco products, SIC 21, was included with "other manufacturing industries."
2/ Less than $0.5 million.
(D) Data have been withheld to avoid disclosing operations of individual companies.
(S) Data have been withheld due to imputation of more than 50 percent.
(T) Data are not separately available, but are included in total.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-28. Company and other (except Federal) funds for industrial energy R&D performance, by selected industry: 1980-90, and projected 1991

[Dollars in millions]

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Industry	SIC code	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Projected 1991
Total		$2,599	$2,680	$2,762	$2,842	$2,962	$2,537	$2,167	$2,410	$2,353	$2,271	$2,420	$2,468
Chemicals and allied products	28	(T)	149	178	166	169	(D)	(D)	(D)	(D)	99	145	176
Petroleum refining and extraction	13,29	699	957	1,096	1,218	(D)	1,145	957	911	983	985	963	1009
Machinery	35	(T)	(T)	(T)	(T)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Electrical equipment	36	205	203	146	132	123	71	(D)	(D)	(D)	(D)	(D)	(D)
Aircraft and missiles	372,376	163	124	99	(T)	190	264	236	(D)	279	246	392	384
All other manufacturing industries		(T)	1,053	1,079	(T)	779	610	497	564	478	(D)	(D)	(D)
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	154	194	164	143	189	84	(D)	170	(S)	243	283	276

(D) Data have been withheld to avoid disclosing operations of individual companies.
(S) Data have been withheld due to imputation of more than 50 percent.
(T) Data are not separately available, but are included in total.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-29. Federal funds for industrial energy R&D performance, by selected industry: 1980-90, and projected 1991

[Dollars in millions]

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Industry	SIC code	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Projected 1991
Total		$1,563	$1,536	$1,478	$1,503	$1,484	$1,417	$1,191	$1,166	$1,385	$1,265	$1,319	$1,436
Chemicals and allied products	28	(T)	163	169	179	22	(D)	(D)	(D)	(D)	31	14	5
Petroleum refining and extraction	13,29	146	110	66	66	(D)	54	42	3	6	4	3	9
Machinery	35	(T)	(T)	(T)	(T)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Electrical equipment	36	711	705	685	681	629	662	(D)	(D)	(D)	(D)	(D)	(D)
	372,376	283	288	264	(T)	471	417	302	(D)	447	368	348	480
All other manufacturing industries		(T)	90	83	(T)	52	13	4	5	(D)	(D)	(D)	(D)
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	179	180	211	206	235	254	(D)	263	(S)	253	316	281

(D) Data have been withheld to avoid disclosing operations of individual companies.
(S) Data have been withheld due to imputation of more than 50 percent.
(T) Data are not separately available, but are included in total.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-30. Total (company, Federal, and other) funds for industrial energy R&D performance, by primary energy source: 1980-90, and projected 1991

[Dollars in millions]

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Primary energy source	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Projected 1991
Total	$4,162	$4,216	$4,240	$4,345	$4,446	$3,954	$3,358	$3,576	$3,738	$3,536	$3,739	$3,904
Fossil fuels	1,228	1,437	1,491	1,573	1,738	1,876	1,476	1,548	1,606	1,601	1,575	$1,566
Oil	N/A	772	N/A	905	N/A	1,395	N/A	(S)	N/A	(S)	N/A	N/A
Gas	N/A	208	N/A	255	N/A	189	N/A	191	N/A	(S)	N/A	N/A
Shale	N/A	57	N/A	48	N/A	125	N/A	11	N/A	72	N/A	N/A
Coal	N/A	383	N/A	(T)	N/A	150	N/A	46	N/A	(S)	N/A	N/A
Synthetic fossil fuels	N/A	210	N/A	(T)	N/A	111	N/A	23	N/A	14	N/A	N/A
Mining	N/A	31	N/A	(T)	N/A	8	N/A	3	N/A	(S)	N/A	N/A
Other	N/A	142	N/A	(T)	N/A	31	N/A	(S)	N/A	(S)	N/A	N/A
Other fossil fuels	N/A	17	N/A	(T)	N/A	17	N/A	51	N/A	(S)	N/A	N/A
Nuclear	1,056	1,037	1,078	1,118	1,113	1,212	979	926	1,097	943	1,039	$1,112
Fission	N/A	866	N/A	973	N/A	1,062	N/A	859	N/A	866	N/A	N/A
Fusion	N/A	171	N/A	145	N/A	150	N/A	(S)	N/A	77	N/A	N/A
Total geothermal, solar, and conservation and utilization	N/A	774	N/A	1,424	1,218	471	504	421	497	582	584	673
Geothermal	N/A	71	N/A	(T)	N/A	54	N/A	48	N/A	16	N/A	N/A
Solar	N/A	298	N/A	(T)	N/A	96	N/A	95	N/A	(S)	N/A	N/A
Conservation and utilization	N/A	405	N/A	(T)	N/A	321	N/A	281	N/A	417	N/A	N/A
All other energy	N/A	968	N/A	230	377	395	399	(S)	538	410	541	553

(D) Data have been withheld to avoid disclosing the operations of individual companies.
(S) Data have been withheld due to imputation of more than 50 percent.
(T) Data are not separately available, but are included in total.

N/A Not available

NOTE: Detailed data for 1981, 1983, 1985, 1987, and 1989 were estimated on the basis of (a) data actually reported in those years, (b) revised data for those years reported on the 1982, 1984, 1986, 1988 and 1990 survey forms, and (c) adjustments to new samples in 1981 and 1987.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-31. Company and other (except Federal) funds for industrial energy R&D performance, by primary energy source: 1980-90, and projected 1991

[Dollars in millions]

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Primary energy source	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Projected 1991
Total	$2,599	$2,680	$2,762	$2,842	$2,962	$2,537	$2,167	$2,410	$2,353	$2,271	$2,420	$2,468
Fossil fuels	993	1,257	1,361	1,455	1,509	1,797	(D)	(D)	1,543	(D)	1,404	1,398
Oil	N/A	746	N/A	(T)	N/A	1,381	N/A	(S)	N/A	(S)	N/A	N/A
Gas	N/A	(T)	N/A	(T)	N/A	(D)	N/A	(S)	N/A	(S)	N/A	N/A
Shale	N/A	(T)	N/A	(T)	N/A	124	N/A	(S)	N/A	(S)	N/A	N/A
Coal	N/A	244	N/A	(T)	N/A	(S)	N/A	29	N/A	(S)	N/A	N/A
Synthetic fossil fuels	N/A	132	N/A	(T)	N/A	91	N/A	(S)	N/A	(D)	N/A	N/A
Mining	N/A	24	N/A	(T)	N/A	8	N/A	(D)	N/A	(D)	N/A	N/A
Other	N/A	89	N/A	(T)	N/A	(S)	N/A	(D)	N/A	(S)	N/A	N/A
Other fossil fuels	N/A	(T)	N/A	(T)	N/A	17	N/A	(S)	N/A	(S)	N/A	N/A
Nuclear	150	126	99	90	101	150	91	109	118	84	155	162
Fission	N/A	70	N/A	71	N/A	135	N/A	82	N/A	57	N/A	N/A
Fusion	N/A	56	N/A	19	N/A	15	N/A	(S)	N/A	27	N/A	N/A
Total geothermal, solar, and conservation and utilization	N/A	573	N/A	1,147	1,086	313	(D)	(D)	319	(D)	397	468
Geothermal	N/A	40	N/A	(T)	N/A	27	N/A	(D)	N/A	(D)	N/A	N/A
Solar	N/A	199	N/A	(T)	N/A	51	N/A	41	N/A	(D)	N/A	N/A
Conservation and utilization	N/A	334	N/A	(T)	N/A	235	N/A	(D)	N/A	281	N/A	N/A
All other energy	N/A	724	N/A	150	267	277	(D)	(D)	373	(D)	464	440

(D) Data have been withheld to avoid disclosing operations of individual companies.
(S) Data have been withheld due to imputation of more than 50 percent.
(T) Data are not separately available, but are included in total.

N/A Not available

NOTE: Detailed data for 1981, 1983, 1985, 1987, and 1989 were estimated on the basis of (a) data actually reported in those years, (b) revised data for those years reported on the 1980, 1982, 1984, 1986, 1988, and 1990 survey forms and, (c) adjustments to new samples in 1981 and 1987.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-32. Federal funds for industrial energy R&D performance, by primary energy source: 1980-90, and projected 1991

[Dollars in millions]

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Primary energy source	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Projected 1991
Total	$1,563	$1,536	$1,478	$1,503	$1,484	$1,417	$1,191	$1,166	$1,385	$1,265	$1,319	$1,436
Fossil fuels	235	180	130	117	228	78	(D)	(D)	63	(D)	171	(S)
Oil	N/A	26	N/A	(T)	N/A	13	N/A	(S)	N/A	(S)	N/A	N/A
Gas	N/A	(T)	N/A	10	N/A	(D)	N/A	(D)	N/A	(S)	N/A	N/A
Shale	N/A	(T)	N/A	1	N/A	1	N/A	(D)	N/A	(S)	N/A	N/A
Coal	N/A	139	N/A	76	N/A	(S)	N/A	17	N/A	(S)	N/A	N/A
Synthetic fossil fuels	N/A	78	N/A	(T)	N/A	20	N/A	8	N/A	(D)	N/A	N/A
Mining	N/A	7	N/A	(T)	N/A	0	N/A	(D)	N/A	(D)	N/A	N/A
Other	N/A	53	N/A	(T)	N/A	(S)	N/A	(D)	N/A	(S)	N/A	N/A
Other fossil fuels	N/A	(T)	N/A	16	N/A	0	N/A	1	N/A	(S)	N/A	N/A
Nuclear	906	911	979	1,029	1,013	1,063	888	817	979	859	884	950
Fission	N/A	796	N/A	902	N/A	928	N/A	777	N/A	809	N/A	N/A
Fusion	N/A	115	N/A	127	N/A	135	N/A	(S)	N/A	50	N/A	N/A
Total geothermal, solar, and conservation and utilization	N/A	201	N/A	277	132	158	(D)	(D)	178	(D)	187	205
Geothermal	N/A	31	N/A	(T)	N/A	26	N/A	(D)	N/A	(D)	N/A	N/A
Solar	N/A	99	N/A	(T)	N/A	45	N/A	37	N/A	(D)	N/A	N/A
Conservation and utilization	N/A	71	N/A	80	N/A	87	N/A	(D)	N/A	(D)	N/A	N/A
All other energy	N/A	244	N/A	80	110	118	(D)	(D)	165	(D)	77	113

(D) Data have been withheld to avoid disclosing operations of individual companies.
(S) Data have been withheld due to imputation of more than 50 percent.
(T) Data are not separately available, but are included in total.

N/A Not available

NOTE: Detailed data for 1981, 1983, 1985, 1987, and 1989 were estimated on the basis of (a) data actually reported in those years, (b) revised data for those years reported on the 1980, 1982, 1984, 1986, 1988, and 1990 survey forms, and (c) adjustments to new samples in 1981 and 1987.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-33. Number of companies performing energy research and development, by industry, by size of company: 1990

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Industry	SIC code	Size of company [Based on number of employees]											
		Less than 500 employees		500 to 999 employees		1,000 to 4,999 employees		5,000 to 9,999 employees		10,000 to 24,999 employees		25,000 or more employees	
		Total	Energy	Total	Energy	Total	Energy	Total	Energy	Total	Energy	Total	Energy
Total		22,280	29	751	4	999	41	200	24	169	31	132	26
Food, kindred, and tobacco products	20,21	8	0	34	0	46	0	16	1	14	1	14	0
Textiles and apparel	22,23	286	0	108	0	43	1	7	0	11	0	2	0
Lumber, wood products, and furniture	24,25	79	0	28	0	32	1	9	0	3	0	1	0
Paper and allied products	26	256	0	13	0	32	0	11	1	9	1	4	1
Chemicals and allied products	28	2,326	1	33	1	58	6	15	2	20	0	10	1
Industrial chemicals	281-82,286	204	0	9	1	19	2	8	2	5	0	5	1
Drugs and medicines	283	407	0	6	0	8	0	2	0	9	0	4	0
Other chemicals	284-85,287-89	1,715	1	18	0	31	4	5	0	6	0	1	0
Petroleum refining	29	104	0	4	0	10	0	5	2	4	4	7	5
Rubber products	30	308	0	36	0	129	2	6	1	4	0	2	0
Stone, clay, and glass products	32	88	0	25	1	30	1	3	1	6	2	2	0
Primary metals	33	169	0	22	0	41	1	10	0	5	2	3	1
Ferrous metals and products	331-32,3398-99	79	0	10	0	22	0	6	0	1	1	2	1
Nonferrous metals and products	333-36	90	0	12	0	19	1	4	0	4	1	1	0
Fabricated metal products	34	1,796	11	71	0	58	0	9	0	6	0	1	1
Machinery	35	2,539	1	89	0	120	5	26	2	10	1	7	1
Office, computing, and accounting machines	357	438	0	17	0	27	0	10	0	3	0	4	0
Other machinery, except electrical	351-56,358-59	2,101	1	72	0	93	5	16	2	7	1	3	1
Electrical equipment	36	3,414	0	101	1	107	5	17	1	15	1	16	6
Radio and TV receiving equipment	365	172	0	3	0	3	0	1	0	0	0	0	0
Communication equipment	366	614	0	15	0	17	1	4	0	5	0	8	2
Electronic components	367	1,258	0	32	0	35	1	7	1	4	0	3	1
Other electrical equipment	361-64,369	1,370	0	51	1	52	3	5	0	6	1	5	3
Transportation equipment	37	156	0	28	0	40	2	12	1	16	3	18	5
Motor vehicles & motor vehicles equipment	371	100	0	21	0	22	1	6	0	6	1	4	0
Other transportation equipment	373-75,379	53	0	2	0	7	0	1	0	4	1	0	0
Aircraft and missiles	372,376	3	0	5	0	11	1	5	1	6	1	14	5

See explanatory information and SOURCE at end of table.

Table A-33. Number of companies performing energy research and development, by industry, by size of company: 1990

Page 2 of 2

Industry	SIC code	Size of company [Based on number of employees]											
		Less than 500 employees		500 to 999 employees		1,000 to 4,999 employees		5,000 to 9,999 employees		10,000 to 24,999 employees		25,000 or more employees	
		Total	Energy	Total	Energy	Total	Energy	Total	Energy	Total	Energy	Total	Energy
Professional and scientific instruments..............	38	1,778	0	36	0	43	2	7	1	3	0	5	0
Scientific and mechanical measuring instruments..	381-82	954	0	14	0	19	1	3	1	1	0	1	0
Optical, surgical, photographic, and other instruments..	383-87	824	0	22	0	24	1	4	0	2	0	4	0
Other manufacturing industries.........................	27,31,39	309	0	35	0	36	1	8	0	7	0	2	0
Nonmanufacturing industries..........................	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	8,664	16	88	1	174	14	39	11	36	16	38	5

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-34. Total (company, Federal, and other) funds for industrial pollution-abatement R&D performance, by industry: 1980-90, and projected 1991

[Dollars in millions]

Industry	SIC code	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Projected 1991
Total		$1,202	(S)	(S)	(S)	$1,060	(S)	(S)	(S)	(S)	$1,372	$1,390	$1,578
Food, kindred, and tobacco products 1/	20,21	3	$1	$1	$9	12	$1	$1	$1	$1	3	2	2
Textiles and apparel	22,23	(T)	(T)	(T)	(T)	(S)	2/	(D)	2/	(S)	2/	2/	2/
Lumber, wood products, and furniture	24,25	4	5	3	2	(D)	1	(D)	(D)	(D)	(D)	(D)	(D)
Paper and allied products	26	(T)	(T)	9	6	7	8	7	7	9	19	18	18
Chemicals and allied products	28	178	186	191	167	158	(S)	168	117	136	178	169	(S)
Industrial chemicals	281-82,286	158	165	173	144	140	(S)	(S)	(D)	117	61	(D)	(S)
Drugs and medicines	283	4	6	6	11	8	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Other chemicals	284-85,287-89	16	15	12	12	10	14	(D)	12	(D)	(D)	71	(S)
Petroleum refining and extraction	13,29	95	92	97	81	88	60	63	51	60	75	72	78
Rubber products	30	3	(T)	2	1	(D)	(D)	(D)	(D)	(S)	1	1	2/
Stone, clay, and glass products	32	11	9	7	9	(S)	3	4	(D)	(D)	(D)	(D)	(D)
Primary metals	33	30	24	22	21	21	-20	8	5	9	10	8	11
Ferrous metals and products	331-32,3398-99	14	15	13	10	13	11	2	(D)	(D)	(D)	(D)	(D)
Nonferrous metals and products	333-36	16	9	9	11	8	9	6	(D)	(D)	(D)	(D)	(D)
Fabricated metal products	34	7	3	11	7	14	6	(D)	(D)	(D)	1	2	2
Machinery	35	30	34	30	27	26	26	33	38	46	111	116	124
Office, computing, and accounting machines	357	1	0	0	0	(D)	0	0	0	0	0	0	0
Other machinery, except electrical	351-56,358-59	29	34	30	27	(D)	26	33	38	46	111	116	124
Electrical equipment	36	39	39	24	13	(D)	(D)	5	(D)	(D)	9	11	13
Radio and TV receiving equipment	365	0	0	0	0	0	0	0	0	0	0	0	0
Communication equipment	366	6	(T)	(T)	(T)	(D)	1	1	(D)	(D)	7	8	9
Electronic components	367	(T)	(T)	(T)	(T)	(S)	2/	(D)	(D)	0	(D)	2	2
Other electrical equipment	361-64,369	(T)	(T)	(T)	12	(D)	(D)	(D)	(D)	(D)	(D)	1	2
Transportation equipment	37	(T)	(T)	(T)	(T)	(S)	(S)	(S)	(S)	(S)	(S)	(S)	(S)
Motor vehicles & motor vehicles equipment	371	(T)	(T)	(T)	(T)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Other transportation equipment	373-75,379	(T)	0	0	(T)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Aircraft and missiles	372,376	38	30	(T)	(T)	(D)	(S)	87	123	103	120	195	226

See explanatory information and SOURCE at end of table.

Table A-34. Total (company, Federal, and other) funds for industrial pollution-abatement R&D performance, by industry: 1980-90, and projected 1991

[Dollars in millions]

Page 2 of 2

Industry	SIC code	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Projected 1991
Professional and scientific instruments	38	(T)	(T)	(T)	$3	$2	$2	(D)	(D)	$3	(D)	$4	$4
Scientific and mechanical measuring instruments	381-82	(T)	(T)	(T)	1	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Optical, surgical, photographic, and other instruments	383-87	(T)	(T)	(T)	2	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Other manufacturing industries	27,31,39	$3	(T)	(T)	2	3	(S)	$0	(D)	(D)	$1	2/	(D)
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	79	$77	$65	124	113	118	80	$113	(S)	(S)	(S)	(S)

1/ Until 1984, tobacco products, SIC 21, was included with "other manufacturing industries."

2/ Less than $0.5 million.

(D) Data have been withheld to avoid disclosing operations of individual companies.

(S) Data have been withheld due to imputation of more than 50 percent.

(T) Data are not separately available, but are included in total.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-35. Company and other (except Federal) funds for industrial pollution-abatement R&D performance, by selected industry: 1980-90, and projected 1991

[Dollars in millions]

Page 1 of 1

Industry	SIC code	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Projected 1991
Total		$1,095	(S)	(S)	(S)	(S)	(S)	(S)	(S)	(S)	(S)	(S)	(S)
Chemicals and allied products	28	130	128	123	101	(D)	(S)	(D)	(D)	(D)	(D)	169	(D)
Petroleum refining and extraction	13,29	93	92	97	82	(D)	61	63	51	60	(D)	(D)	78
Machinery	35	(T)	(T)	(T)	(T)	(D)	(D)	33	38	46	(D)	116	124
Electrical equipment	36	19	19	12	13	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Aircraft and missiles	372,376	26	20	22	17	24	(D)	(D)	62	(D)	70	(D)	(D)
All other manufacturing industries		705	(T)	(T)	(T)	565	(D)	676	(D)	(D)	737	674	681
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	63	39	38	51	47	(D)	(D)	(D)	(D)	58	(D)	(D)

(D) Data have been withheld to avoid disclosing operations of individual companies.
(S) Data have been withheld due to imputation of 50 percent or more.
(T) Data are not separately available, but are included in total.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-36. Federal funds for industrial pollution-abatement R&D performance, by selected industry: 1980-90, and projected 1991

[Dollars in millions]

Page 1 of 1

Industry	SIC code	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Projected 1991
Total		$107	$129	$122	$176	$169	$169	$148	$186	$191	(S)	(S)	$204
Chemicals and allied products	28	48	58	68	66	(D)	(D)	(D)	(D)	(D)	(D)	0	(D)
Petroleum refining and extraction	13,29	2	0	0	0	(D)	0	0	0	0	(D)	(D)	0
Machinery	35	(T)	(T)	(T)	(T)	(D)	(D)	0	0	0	(D)	0	0
Electrical equipment	36	20	20	12	5	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Aircraft and missiles	372,376	12	10	(T)	(T)	(D)	(D)	(D)	61	(D)	50	(D)	(D)
All other manufacturing industries		6	3	(T)	(T)	(D)	(D)	(D)	(D)	0	0	0	0
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	16	38	26	74	67	(D)	(D)	(D)	(D)	(D)	(D)	(D)

(D) Data have been withheld to avoid disclosing information about individual companies.
(S) Data have been withheld due to imputation of 50 percent or more.
(T) Data are not separately available, but are included in total.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-37. Number of full-time-equivalent (FTE) R&D scientists and engineers in R&D-performing companies, by industry and size of company: 1981-91

[In thousands]

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Industry and size of company	SIC code	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Total (January)		487.8	509.8	540.9	584.1	622.5	671.0	695.8	708.6	720.2	730.9	709.7
Total (Annual average)		498.8	525.4	562.5	603.3	646.8	683.4	702.2	714.4	725.6	720.3	N/A
Distribution by industry												
Food, kindred, and tobacco products 1/	20,21	7.4	7.4	7.7	7.4	(S)	(S)	(S)	(S)	(S)	8.8	9.8
Textiles and apparel	22,23	2.0	1.9	2.2	2.3	2.8	2.6	2.4	2.4	2.4	(S)	(S)
Lumber, wood products, and furniture	24,25	1.6	(T)	1.8	(T)	(S)	(S)	1.3	1.3	(S)	(S)	(S)
Paper and allied products	26	8.0	8.4	7.6	6.6	6.6	6.4	6.0	6.1	5.7	(S)	(S)
Chemicals and allied products	28	54.7	61.6	67.3	69.8	71.1	75.8	75.2	75.8	77.6	78.9	79.9
Industrial chemicals	281-82,286	21.6	25.9	26.6	25.6	23.5	24.9	(S)	(S)	(S)	(S)	(S)
Drugs and medicines	283	23.3	25.6	20.2	(T)	30.8	31.8	32.6	33.0	34.0	33.5	34.5
Other chemicals	284-85,287-89	9.8	10.1	12.1	13.4	16.7	19.1	20.2	20.3	20.5	22.4	22.1
Petroleum refining and extraction	13,29	13.0	15.6	14.7	13.3	13.5	10.4	9.9	9.5	10.3	10.2	10.0
Rubber products	30	10.3	8.1	(T)	(T)	(S)	(S)	(S)	(S)	(S)	(S)	(S)
Stone, clay, and glass products	32	5.6	5.1	5.5	5.6	6.6	7.5	8.6	8.6	8.5	8.6	8.3
Primary metals	33	7.9	8.4	8.3	8.4	7.1	5.7	5.5	5.6	5.7	(S)	(S)
Ferrous metals and products	331-32,3398-99	4.8	5.2	5.2	5.3	4.2	2.5	(S)	2.3	(S)	(S)	(S)
Nonferrous metals and products	333-36	3.1	3.2	3.0	3.1	2.9	3.2	3.4	3.3	3.3	3.4	(S)
Fabricated metal products	34	7.8	8.2	(T)	16.6	(S)	(S)	9.9	10.5	9.7	(S)	(S)
Machinery	35	69.2	76.0	79.6	87.0	81.7	89.7	95.8	98.4	99.8	112.3	107.0
Office, computing, and accounting machines	357	43.7	48.1	52.6	56.5	61.8	71.9	73.4	74.4	76.7	88.6	82.8
Other machinery, except electrical	351-56,358-59	25.5	27.9	27.0	30.5	19.9	17.8	22.4	24.0	23.1	23.7	24.2
Electrical equipment	36	106.9	109.8	108.6	113.2	113.2	117.9	130.4	132.5	140.6	138.0	141.0
Radio and TV receiving equipment	365	7.9	7.8	(T)	(T)	(S)	1.8	1.2	1.3	1.3	0.6	0.6
Communication equipment	366	44.2	45.9	48.8	59.3	62.2	65.0	71.9	73.1	72.8	74.2	73.8
Electronic components	367	22.8	24.4	25.6	(T)	29.2	(S)	43.7	44.3	(S)	48.5	(S)
Other electrical equipment	361-64,369	32.0	31.7	(T)	18.4	17.9	16.5	13.6	(S)	16.7	(S)	(S)
Transportation equipment	37	131.7	122.3	134.3	(T)	160.3	179.2	187.3	188.2	193.0	183.7	168.2
Motor vehicles and motor vehicles equipment	371	35.1	30.0	29.0	28.6	28.7	33.9	46.5	47.3	45.9	49.6	45.5
Other transportation equipment	373-75,379	1.4	1.2	2.2	(T)	(S)	(S)	(S)	(S)	(S)	(S)	(S)
Aircraft and missiles	372,376	95.2	91.1	103.1	111.5	130.2	144.8	136.3	136.4	142.3	128.5	118.3

See explanatory information and SOURCE at end of table.

Table A-37. Number of full-time-equivalent (FTE) R&D scientists and engineers in R&D-performing companies, by industry and size of company: 1981-91

[In thousands]

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Industry and size of company	SIC code	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Distribution by industry												
Professional and scientific instruments	38	34.7	42.7	(T)	(T)	(S)	(S)	(S)	(S)	(S)	(S)	(S)
Scientific and mechanical measuring instruments	381-82	18.6	(T)	(T)	(T)	(S)	(S)	(S)	(S)	(S)	(S)	(S)
Optical, surgical, photographic, and other instruments	383-87	16.0	16.1	(T)	(T)	19.8	24.0	24.6	24.9	24.2	(S)	(S)
Other manufacturing industries 1/	27,31,30	4.8	5.5	5.9	(T)	(S)	(S)	6.3	6.4	5.4	(S)	(S)
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	22.2	27.1	31.2	49.8	66.8	75.1	96.4	101.9	(S)	(S)	(S)
Distribution by size of company [Based on number of employees]												
Less than 500 2/		38.0	40.7	52.7	81.9	78.3	(S)	105.2	109.0	(S)	(S)	(S)
500 to 999 3/		N/A	N/A	N/A	N/A	16.5	(S)	18.4	19.3	17.9	18.3	(S)
1,000 to 4,999		38.9	42.8	48.3	52.6	61.6	66.7	76.4	81.9	75.9	74.1	69.8
5,000 to 9,999		27.2	36.6	29.8	30.1	28.5	38.9	40.5	40.2	47.1	56.2	49.9
10,000 to 24,999		71.8	77.0	84.3	84.0	89.9	88.4	92.0	94.5	86.7	72.6	82.6
25,000 or more		311.8	312.7	325.8	335.5	347.6	365.3	363.3	365.2	387.5	397.3	379.4

1/ Until 1984, tobacco products (SIC 21) was included with "other manufacturing industries."

2/ Until 1984, data represent companies with less than 1,000 employees.

3/ See footnote #2

(S) Data have been withheld due to imputation of 50 percent or more.

(T) Data are not separately available, but are included in total.

N/A Not available

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-38. Cost per R&D scientist or engineer in R&D-performing companies, by industry and size of company: 1980-90

Page 1 of 2

Industry and size of company	SIC code	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Total		$94,900	$103,900	$111,600	$116,000	$124,000	$130,200	$128,500	$131,200	$137,000	$140,600	$144,900
Distribution by industry												
Food, kindred, and tobacco products 1/	20,21	84,900	(D)	(D)	(D)	(D)	(D)	(D)	(S)	(D)	(D)	(D)
Textiles and apparel	22,23	57,500	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Lumber, wood products, and furniture	24,25	89,700	(S)	(S)	(S)	115,400	116,300	(S)	(S)	(D)	(S)	(S)
Paper and allied products	26	64,300	(D)	70,800	(D)	(D)	(D)	(D)	(D)	(D)	(S)	(S)
Chemicals and allied products	28	87,400	96,600	102,500	104,800	112,500	116,300	117,100	127,600	140,400	146,600	158,300
Industrial chemicals	281-82,286	103,400	118,000	122,100	123,100	132,000	144,600	150,200	(S)	(S)	(S)	(S)
Drugs and medicines	283	79,200	(D)	(D)	103,100	(D)	(D)	113,600	(D)	141,700	(D)	(D)
Other chemicals	284-85,287-89	66,500	(D)	(D)	(D)	(D)	(D)	83,100	(D)	101,300	(D)	(D)
Petroleum refining and extraction	13,29	130,400	(D)	(D)	(D)	(D)	(D)	(D)	195,600	196,400	201,600	207,000
Rubber products	30	(D)	(D)	(D)	75,400	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Stone, clay, and glass products	32	73,800	(D)	(D)	(D)	(D)	(D)	118,000	115,700	(D)	(D)	(D)
Primary metals	33	91,000	107,700	118,200	129,900	(D)	(D)	(D)	131,500	117,300	(S)	(D)
Ferrous metals and products	331-32,3398-99	93,300	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(S)	(D)	(D)
Nonferrous metals and products	333-36	87,700	(D)	(D)	(D)	112,000	136,400	138,800	(D)	(S)	(D)	(D)
Fabricated metal products	34	70,500	78,000	(S)	(S)	111,600	112,900	(S)	76,800	82,100	(S)	(S)
Machinery	35	89,900	93,900	103,800	108,400	124,500	142,500	(D)	(D)	(D)	138,400	134,000
Office, computing, and accounting machines	357	92,700	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Other machinery, except electrical	351-56,358-59	84,700	(D)	(D)	(D)	(D)	(D)	119,200	104,700	115,500	(D)	(D)
Electrical equipment	36	91,100	95,300	100,000	114,300	121,700	124,900	120,700	120,800	118,900	121,600	124,700
Radio and TV receiving equipment	365	93,400	(D)	(D)	105,300	(D)	(D)	88,700	111,200	106,900	92,300	164,600
Communication equipment	366	92,900	105,500	123,300	135,000	143,000	147,800	141,300	140,500	141,100	140,800	140,200
Electronic components	367	75,600	66,700	69,600	(S)	100,500	114,100	(D)	97,400	(S)	(S)	(S)
Other electrical equipment	361-64,369	98,300	(D)	(D)	(D)	(D)	(D)	(D)	(S)	78,700	(S)	(S)
Transportation equipment	37	N/A	N/A	(D)	(D)	(D)	(D)	170,700	182,400	190,700	195,700	204,100
Motor vehicles and motor vehicles equipment	371	135,200	147,400	162,600	184,700	211,400	223,100	(D)	(D)	(D)	(D)	(D)
Other transportation equipment	373-75,379	111,700	(D)	(D)	114,200	(D)	(D)	(S)	(S)	(D)	(D)	(D)
Aircraft and missiles	372,376	101,600	128,400	148,800	143,600	158,000	161,700	149,800	179,400	185,900	189,400	205,500

See explanatory information and SOURCE at end of table.

Table A-38. Cost per R&D scientist or engineer in R&D-performing companies, by industry and size of company: 1980-90

Page 2 of 2

Distribution by industry	SIC code	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Professional and scientific instruments	38	$89,700	$93,400	(S)	(S)	$116,900	$122,000	(S)	(S)	(S)	(S)	(S)
Scientific and mechanical measuring instruments	381-82	(D)	(D)	(D)	$83,200	(D)	(D)	(D)	(D)	(S)	(S)	(S)
Optical, surgical, photographic, and other instruments	383-87	103,800	(D)	(D)	141,100	(D)	(D)	(D)	(D)	$150,400	(S)	(S)
Other manufacturing industries 1/	27,31,39	77,400	(D)	(D)	98,500	(D)	(D)	(S)	(D)	(D)	(D)	(D)
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	86,400	77,200	$84,800	82,400	84,100	94,600	$86,800	$79,100	81,300	(S)	(S)
Distribution by size of company [Based on number of employees]												
Less than 500 2/		56,300	58,600	62,800	65,700	55,000	(S)	70,600	74,300	65,800	70,000	(S)
500 to 999 3/		N/A	N/A	N/A	N/A	87,200	(S)	103,400	101,400	(S)	97,500	(S)
1,000 to 4,999		68,600	77,000	84,800	82,800	96,700	97,300	106,400	100,500	106,800	102,800	107,900
5,000 to 9,999		71,400	93,700	82,900	93,400	111,000	119,300	108,400	122,800	123,700	108,800	123,500
10,000 to 24,999		86,200	90,900	98,500	112,900	130,500	124,600	122,300	142,300	135,000	127,800	144,300
25,000 or more		105,800	117,200	128,900	134,200	143,000	155,300	154,300	163,100	172,200	175,700	177,700

1/ Until 1984, tobacco products, SIC 21, was included with "other manufacturing industries."

2/ Until 1984, data represent companies with less than 1,000 employees.

3/ See footnote #2

(D) Data have been withheld to avoid disclosing operations of individual companies.

(S) Data have been withheld due to imputation of 50 percent or more.

N/A Not available

NOTE: The number of full-time-equivalent R&D scientists and engineers used to estimate the cost per R&D scientist or engineer is the arithmetic mean of the numbers of R&D scientists and engineers reported for January in two consecutive years. This number is then divided into the total R&D expenditures of the earlier years, and the ratio is attributed to the earlier year.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-39. Cost per R&D scientist or engineer, by industry, by size of company: 1990

Page 1 of 2

Industry	SIC code	Total	Size of company [Based on number of employees]: Less than 500 employees	500 to 999 employees	1,000 to 4,999 employees	5,000 to 9,999 employees	10,000 to 24,999 employees	25,000 or more employees
Total		$144,900	(S)	(S)	$107,900	$123,500	$144,300	$177,700
Food, kindred, and tobacco products	20,21	(D)	(S)	(S)	120,300	121,700	160,700	157,100
Textiles and apparel	22,23	(D)	(S)	(S)	105,000	32,900	(S)	(D)
Lumber, wood products, and furniture	24,25	(S)	(S)	(S)	128,400	(S)	258,000	(D)
Paper and allied products	26	(S)	(S)	(S)	86,700	71,400	129,300	109,200
Chemicals and allied products	28	158,300	$65,400	(S)	143,000	142,900	189,500	(S)
Industrial chemicals	281-82,286	(S)	(S)	(S)	150,000	152,000	241,500	(S)
Drugs and medicines	- 283	(D)	(S)	$180,100	159,300	(D)	180,600	(S)
Other chemicals	284-85,287-89	(D)	62,800	(S)	130,900	95,400	(S)	(D)
Petroleum refining and extraction	13,29	207,000	43,900	(S)	108,400	273,400	209,400	216,600
Rubber products	30	(D)	(S)	(S)	116,700	(S)	(D)	(D)
Stone, clay, and glass products	32	(D)	(S)	(S)	51,400	(D)	146,500	(D)
Primary metals	33	(D)	(S)	(S)	118,800	(S)	231,400	(S)
Ferrous metals and products	331-32,3398-99	(D)	(S)	(S)	140,800	(S)	(D)	(D)
Nonferrous metals and products	333-36	(D)	(S)	(S)	111,200	(D)	(S)	(D)
Fabricated metal products	34	(S)	(S)	(S)	89,100	191,500	86,900	(D)
Machinery	35	134,000	(S)	(S)	123,500	141,300	118,500	154,100
Office, computing, and accounting machines	357	(D)	(S)	(S)	107,700	147,000	145,000	151,000
Other machinery, except electrical	351-56,358-59	(D)	(S)	(S)	133,900	(S)	102,000	(D)
Electrical equipment	36	124,700	84,100	(S)	90,800	(S)	135,700	139,900
Radio and TV receiving equipment	365	164,600	(S)	(D)	(D)	(D)	0	0
Communication equipment	366	140,200	69,100	(S)	70,400	(S)	161,300	132,000
Electronic components	367	(S)	95,200	(S)	124,200	(S)	122,100	(D)
Other electrical equipment	361-64,369	(S)	(S)	(S)	76,800	99,800	118,600	(D)
Transportation equipment	37	204,100	(S)	(S)	106,300	107,800	133,800	211,700
Motor vehicles and motor vehicles equipment	371	(D)	(D)	(S)	82,500	103,800	84,800	(D)
Other transportation equipment	373-75,379	(D)	(S)	(D)	120,300	(D)	75,900	0
Aircraft and missiles	372,376	205,500	(D)	(D)	112,300	120,500	254,600	206,500

See explanatory information and SOURCE at end of table.

Table A-39. Cost per R&D scientist or engineer, by industry, by size of company: 1990

Industry	SIC code	Total	Size of company [Based on number of employees] Less than 500 employees	500 to 999 employees	1,000 to 4,999 employees	5,000 to 9,999 employees	10,000 to 24,999 employees	25,000 or more employees
Professional and scientific instruments	38	(S)	(S)	$108,600	$80,200	$129,500	$98,800	(S)
Scientific and mechanical measuring instruments	381-82	(S)	(S)	(S)	53,100	(S)	(D)	(D)
Optical, surgical, photographic, and other instruments	383-87	(S)	(S)	108,100	129,100	153,800	(D)	(S)
Other manufacturing industries	27,31,39	(D)	(S)	(S)	84,900	(D)	139,400	(D)
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	(S)	(S)	178,900	112,100	74,700	94,900	(S)

(D) Data have been withheld to avoid disclosing operations of individual companies.
(S) Data have been withheld due to imputation of 50 percent or more.

NOTE: The number of full-time-equivalent R&D scientists and engineers used to estimate the cost per R&D scientist or engineer is the arithmetic mean of the numbers of R&D scientists and engineers reported for January in two consecutive years. This number is then divided into the total R&D expenditures of the earlier years, and the ratio is attributed to the earlier year.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-40. Cost per R&D scientist or engineer in companies ranked by size of R&D program: 1980-90

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Companies ranked by size of R&D program (based on total R&D funds)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
First 4	$126,700	$160,200	$182,800	$185,200	$202,000	$225,800	$225,900	$222,600	$226,200	$218,100	$240,400
Next 4	119,200	138,900	127,600	154,000	167,000	176,200	171,400	196,900	210,700	225,800	194,300
Next 12	93,300	107,000	127,500	119,300	127,800	132,500	131,200	141,600	153,000	148,700	172,100
Next 20	97,400	101,700	104,200	117,800	121,000	144,000	125,600	146,300	154,500	132,500	133,000
Next 60	90,700	96,400	98,000	118,800	130,400	124,100	139,000	128,700	141,300	145,400	161,900
Next 100	71,400	87,900	99,200	96,300	108,900	122,800	146,700	128,600	137,300	141,900	144,400
Next 200	72,800	79,900	86,900	86,400	97,300	94,100	138,000	110,800	124,500	106,100	113,100
Average of above 400 R&D performing companies	96,600	114,400	118,500	125,400	139,000	144,400	160,400	153,100	160,600	161,500	166,300

NOTE: The number of full-time-equivalent R&D scientists and engineers used to estimate the cost per R&D scientist or engineer is the arithmetic mean of the numbers of R&D scientists and engineers reported for January in two consecutive years. This number is then divided into the total R&D expenditures of the earlier years, and the ratio is attributed to the earlier year.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-41. Domestic employment of R&D-performing companies, by industry, by size of company: 1989-90

[In thousands]

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Industry	SIC code	1988 - 1989 Size of company [Based on number of employees] Total	Less than 500	500 to 999	1,000 to 4,999	5,000 to 9,999	10,000 to 24,999	25,000 or more
Total		17,044	(S)	(S)	2,267	1,378	2,891	8,591
Food, kindred, and tobacco products	20,21	1,264	(S)	(S)	(S)	103	194	818
Textiles and apparel	22,23	(S)	(S)	(S)	(S)	(S)	187	141
Lumber, wood products, and furniture	24,25	257	(S)	(S)	79	53	46	0
Paper and allied products	26	558	(S)	(S)	(S)	65	182	189
Chemicals and allied products	28	1,090	(S)	29	169	78	338	378
Industrial chemicals	281-82,286	409	(S)	8	54	49	73	221
Drugs and medicines	283	343	(S)	4	38	(D)	158	(D)
Other chemicals	284-85,287-89	338	(S)	17	77	(D)	107	(D)
Petroleum refining and extraction	13,29	406	(S)	(S)	(S)	33	68	267
Rubber products	30	451	(D)	(S)	(S)	41	93	(D)
Stone, clay, and glass products	32	300	(D)	(S)	(S)	32	88	(D)
Primary metals	33	456	(S)	(S)	107	68	112	126
Ferrous metals and products	331-32,3398-99	246	(D)	(S)	(S)	40	42	(D)
Nonferrous metals and products	333-36	210	(D)	(S)	54	28	70	(D)
Fabricated metal products	34	530	(S)	(S)	125	75	120	0
Machinery	35	1,397	(S)	69	266	180	183	481
Office, computing, and accounting machines	357	624	33	17	60	78	56	379
Other machinery, except electrical	351-56,358-59	773	(S)	52	206	102	127	102
Electrical equipment	36	2,005	(S)	76	240	123	247	1,105
Radio and TV receiving equipment	365	20	(S)	(D)	6	(D)	0	0
Communication equipment	366	971	43	10	43	31	60	785
Electronic components	367	468	(S)	(D)	84	(D)	67	170
Other electrical equipment	361-64,369	546	(S)	38	107	54	120	150
Transportation equipment	37	2,584	(S)	(S)	103	60	255	2,103
Motor vehicles and motor vehicles equipment	371	1,118	(D)	(D)	58	33	86	899
Other transportation equipment	373-75,379	112	(S)	4	21	0	76	0
Aircraft and missiles	372,376	1,354	(D)	(D)	24	27	93	1,204

See explanatory information and SOURCE at end of table.

Table A-41. Domestic employment of R&D-performing companies, by industry, by size of company: 1989-90

[In thousands]

Industry	SIC code	Total	Less than 500	500 to 999	1,000 to 4,999	5,000 to 9,999	10,000 to 24,999	25,000 or more
		1988 - 1989 Size of company [Based on number of employees]						
Professional and scientific instruments	38	593	(S)	25	82	62	41	286
Scientific and mechanical measuring instruments	381-82	203	(S)	9	38	29	(D)	(D)
Optical, surgical, photographic, and other instruments	383-87	390	(S)	16	44	33	(D)	(D)
Other manufacturing industries	27,31,39	339	(S)	(S)	(S)	56	137	0
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	4,199	(S)	(S)	(S)	302	602	2,530

[In thousands]

Industry	SIC code	Total	Less than 500	500 to 999	1,000 to 4,999	5,000 to 9,999	10,000 to 24,999	25,000 or more
		1989 - 1990 Size of company [Based on number of employees]						
Total		16,920	(S)	(S)	(S)	1,439	2,754	8,649
Food, kindred, and tobacco products	20,21	(S)	(S)	(S)	(S)	113	204	(S)
Textiles and apparel	22,23	(S)	(D)	(S)	(S)	(S)	190	(D)
Lumber, wood products, and furniture	24,25	(S)	(D)	(S)	(S)	67	36	(D)
Paper and allied products	26	555	(S)	(S)	(S)	(S)	165	184
Chemicals and allied products	28	1,085	(S)	24	141	103	341	376
Industrial chemicals	281-82,286	409	(S)	6	38	56	81	222
Drugs and medicines	283	328	(S)	4	26	(D)	162	(D)
Other chemicals	284-85,287-89	348	(S)	(S)	77	(D)	(S)	(D)
Petroleum refining and extraction	13,29	403	(S)	(S)	(S)	32	67	266
Rubber products	30	(S)	(D)	(S)	(S)	(S)	57	(D)
Stone, clay, and glass products	32	297	(D)	(S)	(S)	21	94	(D)
Primary metals	33	420	(S)	(S)	101	69	86	121
Ferrous metals and products	331-32,3398-99	211	(S)	(S)	(S)	40	(D)	(D)
Nonferrous metals and products	333-36	209	(S)	(S)	49	29	(D)	(D)

See explanatory information and SOURCE at end of table.

Table A-41. Domestic employment of R&D-performing companies, by industry, by size of company: 1989-90

[In thousands]

Industry	SIC code	Total	Less than 500	500 to 999	1,000 to 4,999	5,000 to 9,999	10,000 to 24,999	25,000 or more
		1989 - 1990 Size of company [Based on number of employees]						
Fabricated metal products	34	(S)	(D)	(S)	(S)	64	(S)	(D)
Machinery	35	1,359	(S)	(S)	271	181	170	460
Office, computing, and accounting machines	357	598	(S)	12	56	72	60	364
Other machinery, except electrical	351-56,358-59	761	(S)	(S)	215	109	110	96
Electrical equipment	36	1,901	(S)	(S)	213	120	263	1,024
Radio and TV receiving equipment	365	20	(S)	(D)	6	(D)	0	0
Communication equipment	366	925	39	11	33	26	94	722
Electronic components	367	452	(S)	(S)	69	50	63	161
Other electrical equipment	361-64,369	504	(S)	(D)	105	(D)	106	141
Transportation equipment	37	2,451	(S)	(D)	(S)	(D)	223	1,998
Motor vehicles and motor vehicles equipment	371	1,057	(D)	(D)	(S)	38	(S)	849
Other transportation equipment	373-75,379	103	(S)	(D)	17	(D)	63	0
Aircraft and missiles	372,376	1,291	(D)	(D)	24	36	77	1,149
Professional and scientific instruments	38	585	(S)	24	93	48	38	283
Scientific and mechanical measuring instruments	381-82	201	(S)	9	42	21	(D)	(D)
Optical, surgical, photographic, and other instruments	383-87	384	(S)	15	51	27	(D)	(D)
Other manufacturing industries	27,31,39	397	(D)	(S)	(S)	59	124	(D)
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	(S)	(S)	(S)	(S)	304	(S)	(S)

(D) Data have been withheld to avoid disclosing operations of individual companies.
(S) Data have been withheld due to imputation of 50 percent or more.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-42. R&D scientists and engineers per 1,000 employees in manufacturing companies, by industry and size of company: 1980-90

Page 1 of 2

Industry and size of company	SIC code	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Distribution by industry												
Total		27	29	33	34	40	43	45	45	47	49	49
Food, kindred,and tobacco products 1/	20,21	5	6	6	6	7	8	7	7	7	7	7
Textiles and apparel	22,23	3	3	4	4	5	5	4	4	(S)	4	4
Lumber, wood products, and furniture	24,25	6	(S)	(S)	(S)	6	6	5	5	5	5	5
Paper and allied products	26	14	16	14	12	13	13	11	11	11	11	12
Chemicals and allied products	28	42	44	51	54	57	57	70	68	70	72	73
Industrial chemicals	281-82,286	36	37	44	45	41	39	56	52	55	56	57
Drugs and medicines	283	60	66	74	(S)	89	81	98	98	99	98	104
Other chemicals	284-85,287-89	30	33	37	39	51	62	63	61	61	63	64
Petroleum refining and extraction	13,29	17	20	22	22	22	21	19	20	24	25	25
Rubber products	30	(S)	25	(S)	(S)	27	26	25	19	(S)	17	17
Stone, clay, and glass products	32	13	13	15	16	17	20	20	24	27	29	29
Primary metals	33	7	8	10	11	12	12	11	12	13	12	13
Ferrous metals and products	331-32,3398-99	6	6	8	11	11	11	7	9	9	8	10
Nonferrous metals and products	333-36	12	13	13	13	16	16	17	16	17	16	16
Fabricated metal products	34	14	15	(S)	(S)	(S)	(S)	(S)	17	17	18	18
Machinery	35	36	35	48	57	56	60	64	67	68	76	81
Office, computing, and accounting machines	357	72	71	80	88	90	99	107	115	116	133	143
Other machinery, except electrical	351-56,358-59	18	19	26	30	32	29	26	29	29	30	32
Electrical equipment	36	44	48	55	51	49	53	59	65	70	70	73
Radio and TV receiving equipment	365	35	51	(S)	(S)	(S)	23	55	45	48	45	29
Communication equipment	366	55	56	74	61	56	62	68	73	83	77	80
Electronic components	367	55	66	68	(S)	(S)	81	82	88	102	105	111
Other electrical equipment	361-64,369	32	34	(S)	(S)	30	30	26	28	26	26	30
Transportation equipment	37	N/A	N/A	N/A	N/A	(S)	71	69	68	73	73	72
Motor vehicles and motor vehicles equipment	371	30	30	31	30	27	28	38	42	41	43	45
Other transportation equipment	373-75,379	9	9	12	(S)	(S)	8	23	38	39	47	49
Aircraft and missiles	372,376	92	98	94	102	110	116	99	91	101	100	96

See explanatory information and SOURCE at end of table.

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Table A-42. R&D scientists and engineers per 1,000 employees in manufacturing companies, by industry and size of company: 1980-90

Industry and size of company	SIC code	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Distribution by industry												
Professional and scientific instruments	38	39	46	(S)	(S)	(S)	(S)	(S)	71	70	76	71
Scientific and mechanical measuring instruments	381-82	(S)	(S)	(S)	(S)	(S)	(S)	(S)	85	94	106	106
Optical, surgical, photographic, and other instruments	383-87	48	47	(S)	(S)	(S)	70	61	63	58	60	53
Other manufacturing industries 1/	27,31,39	7	7	9	(S)	(S)	(S)	(S)	18	18	16	13
Distribution by size of company [Based on number of employees]												
Less than 500 2/		25	28	30	34	42	50	59	59	58	59	55
500 to 999 3/		N/A	N/A	N/A	N/A	21	21	23	27	26	27	28
1,000 to 4,999		19	21	22	25	24	26	32	30	31	30	31
5,000 to 9,999		19	18	23	22	19	19	28	29	29	39	36
10,000 to 24,999		20	23	26	26	29	30	33	32	34	31	33
25,000 or more		34	36	43	42	47	49	56	57	58	62	62

1/ Until 1984, tobacco products, SIC 21, was included with "other manufacturing industries."

2/ Until 1984, data represent companies with less than 1,000 employees.

3/ See footnote #2

(S) Data have been withheld due to imputation of 50 percent or more.

N/A Not available

NOTE: The number of R&D scientists and engineers per 1,000 employees for 1989 is derived by dividing the arithmetic mean of scientists and engineers employed in January 1990 and January 1991 by the number of employees in all activities in March 1990. Similar procedures were used for earlier years. Nonmanufacturing industries are included in pre-1983 calculations.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-43. R&D funds per employee, by size of company: 1980-90

Page 1 of 1

Size of company [Based on number of employees]	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
	Total (company, Federal, and other) R&D funds per employee										
Total	$2,576	$3,010	$3,719	$4,163	$4,579	$5,148	$5,153	$5,338	$5,678	$6,122	$6,167
Less than 500 1/	1418	1,634	1,732	2,186	2,767	3,028	5,414	5,553	5,318	5,618	6,041
500 to 999 2/	N/A	N/A	N/A	N/A	2158	2,238	3,229	3,121	2,900	3,157	3,536
1,000 to 4,999	1,326	1,596	1,790	2,042	2,480	2,725	3,261	3,395	3,232	3,394	3,398
5,000 to 9,999	1,332	1,668	1,883	2,194	2,505	2,851	2,849	3,210	4,009	4,082	4,269
10,000 to 24,999	1,748	2,045	2,469	2,966	3,385	3,500	3,334	3,668	3,725	3,522	4,274
25,000 or more	3,594	4,193	5,502	5,785	6,184	7,071	6,878	7,035	7,547	8,027	7,969
	Company and other (except Federal) R&D funds per employee										
Total	$1,764	$2,059	$2,534	$2,814	$3,095	$3,383	$3,503	$3,562	$3,804	$4,140	$4,357
Less than 500 1/	1,176	1,333	1,381	1,749	2,212	2,407	4,750	4,811	4,686	4,891	5,309
500 to 999 2/	N/A	N/A	N/A	N/A	1,782	1,700	2,997	2,859	2,857	2,988	3,283
1,000 to 4,999	1,108	1,311	1,503	1,687	2,096	2,316	2,725	2,799	2,740	2,931	3,011
5,000 to 9,999	1,048	1,323	1,551	1,613	2,199	2,409	2,316	2,682	3,309	3,493	4,077
10,000 to 24,999	1,414	1,675	2,025	2,351	2,689	2,769	2,697	2,969	3,139	3,085	3,712
25,000 or more	2,273	2,641	3,436	3,637	3,792	4,208	4,077	4,010	4,346	4,873	4,872

1/ Until 1984, data represent companies with less than 1,000 employees.
2/ See footnote #1

N/A Not available

NOTE: Averages were derived by dividing total and company R&D funds for a calendar year by employment data for March of that year.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table A-44. Concentration of total employment in R&D-performing companies ranked by size of R&D program: 1984-1990

[Percent]

Page 1 of 1

Companies	1984	1985	1986	1987	1988	1989	1990
First 4 (1-4)	8 %	8 %	7 %	7 %	7 %	7 %	5 %
Next 4 (5-8)	3	4	4	4	3	3	4
Next 12 (9-20)	6	7	5	6	6	6	6
Next 20 (21-40)	9	7	6	6	5	4	5
Next 60 (41-100)	10	11	9	8	9	10	10
Next 100 (101-200)	13	12	7	7	8	8	8
Next 200 (201-400)	15	15	10	9	9	9	11
All others	36	36	52	53	53	53	51

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Section B. Technical Notes

Introduction

The Survey of Research and Development in Industry provides national estimates of the total expenditures on R&D performed within the United States by industrial firms, whether U.S.- or foreign-owned. It is a sample survey in which it is intended that all R&D-performing companies, including privately held firms, are included or represented. All companies that are identified in the sample year as annually spending more than $1 million on R&D in the United States receive a survey form every year. Information from individual companies in the sample is used to develop national estimates on an industry-by-industry basis.

NSF has been sponsoring a survey of industrial R&D since 1953. The 1990 Survey of Research and Development in Industry is the 34th in the annual series sponsored by NSF and conducted since 1957 by Census. NSF's Division of Science Resources Studies monitors the survey. NSF also sponsored two industrial R&D surveys covering the 1953-56 period that were conducted by the Bureau of Labor Statistics (BLS), U.S. Department of Labor.[1] Data obtained in the earlier BLS surveys are not directly comparable with Census figures for 1957-88 because of methodological and other differences in the surveys.

Respondents receive detailed definitions to help them determine which expenses to include or exclude from the R&D data they provide. Nevertheless, the statistics presented in this report are subject to response and concept errors caused by different respondent interpretations of the definitions of R&D activities and by variations in company accounting procedures. Consequently, the data are better indicators of changes in, rather than absolute levels of, R&D spending and personnel. Data quality has improved substantially since the first industry R&D survey was undertaken, mainly because respondents have adopted more accurate and sophisticated accounting procedures over the years.

The survey's primary focus is on U.S. industry as a performer of, rather than as a source of funds for, R&D. Thus, data on Federal support of R&D activities performed by industry are collected and appear in several tables, but data on industrial funding of R&D undertaken at universities and colleges and other nonprofit organizations are not included in the major tables.[2]

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[1] National Science Foundation, *Science and Engineering in American Industry. Final Report on a 1953-54 Survey* (NSF 56-16) and *Science and Engineering in American Industry, 1956* (NSF 59-50) (Washington, D.C.: Supt. of Documents, U.S. Government Printing Office, 1956 and 1960)

The survey data provide: (1) national estimates of total R&D performed by industry in the United States; (2) the portion of the effort that is financed by U.S. Government funds; and (3) the amount financed by the companies themselves or by other non-Federal sources such as state and local governments or other industrial firms (Chart 1). Also included are data on both the number of employees and the number of R&D-performing scientists and engineers at the firm, as well as on the domestic net sales for the company, and on the total funds for R&D financed by the domestic firm but performed outside the United States. A complete list of tables developed from the survey data is presented in Section A, and copies of the 1990 survey form and other survey documents are printed in Section D.

The scope of the survey has been expanded and refined over the years in response to an increasing policy need for more detailed information on the Nation's R&D effort. For example, questions on energy R&D were added in the early seventies, following the first oil-shortage crisis. On the other hand, the frequency of collection of certain data items has been reduced in an attempt to alleviate some of the respondent burden that has been placed on industry from all sources in recent years. The detailed questionnaire is now mailed only in odd-numbered years; abbreviated survey forms containing only the most crucial data elements are sent to respondents in the intervening, even-numbered years. The shortened survey form was used for the first time to collect industrial R&D data for 1978. Both long and short survey forms are called RD-1. This report provides data collected from the short form that covers 1990 data.

Questions appearing only biennially, on the long form, request detail on such areas as the following: R&D, by product field; company expenditures for R&D projects that were contracted to outside organizations, rather than performed in-house; Federal R&D support to the firm, by contracting agency; R&D expenditures by geographic area; and some detailed data on energy and pollution-abatement R&D activities.

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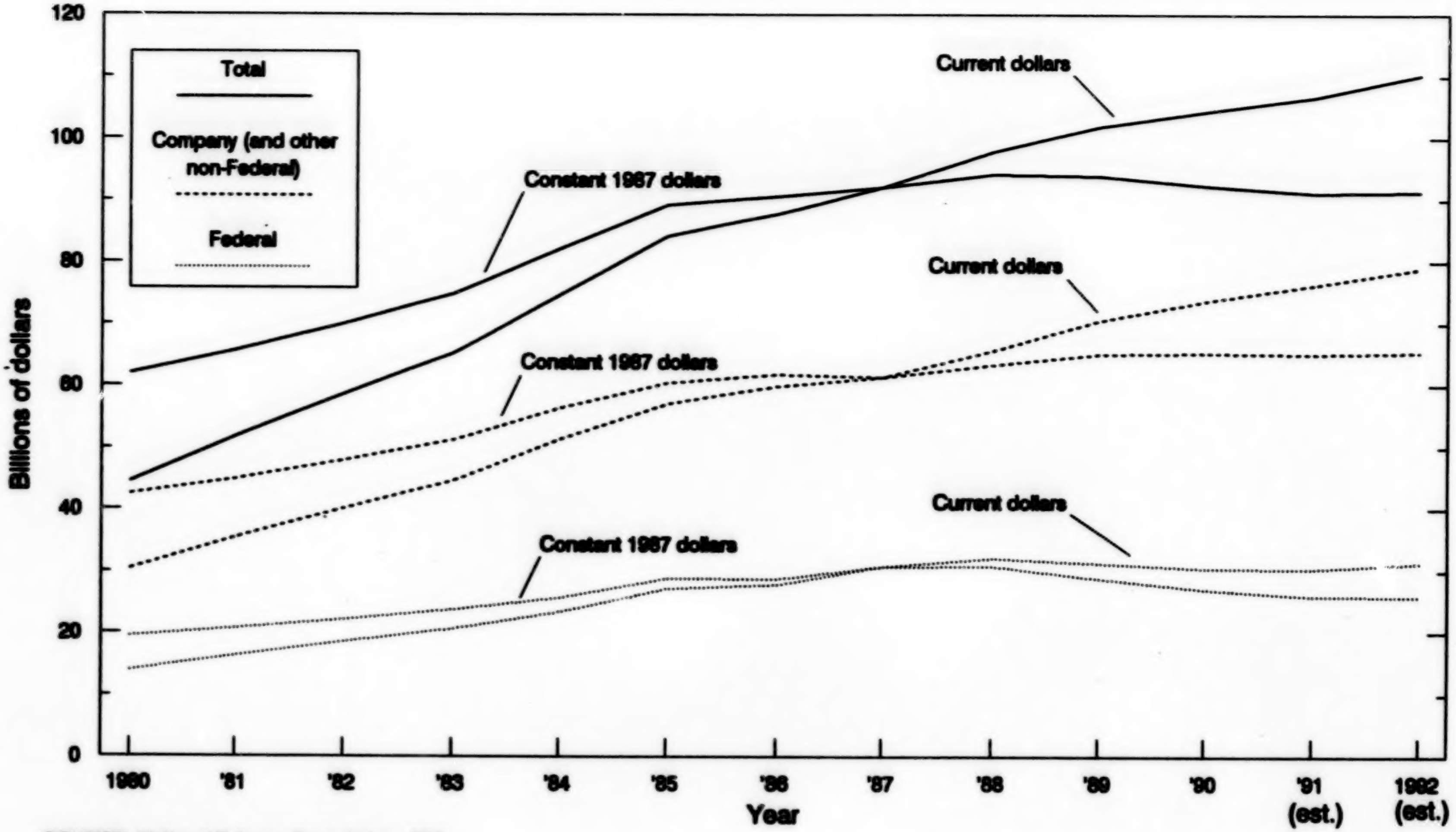
[2] Data on industry funding of R&D performed at universities and colleges are collected in the annual Survey of Scientific and Engineering Expenditures at Universities and Colleges. More information about this survey is available from the Science and Engineering Activities Program of NSF's Division of Science Resources Studies, (703) 306-1772.

Chart 1. Industrial R&D performance, by source of funds



SOURCE: National Science Foundation, SRS

Survey Methodology[3]

Overview

Data in this survey are based on a sample of industrial firms, selected approximately every five years (e.g., 1976, 1981, 1987). In intervening years, only a subset of the sample, or panel, receives annual survey forms (for a complete discussion, see **The Annual Panel**), and Census makes estimates for the changes in R&D for the firms not canvassed annually. The sampling unit for this survey is the enterprise, or company, defined as a business organization consisting of one or more establishments under common ownership or control. The 1990 data in this publication are based on responses from a panel derived from the sample selected and first used for survey year 1987 (Table B-1). [The previous sample was selected for the 1981 survey and the panel was used in subsequent annual surveys until 1987.]

The sampling frame from which the sample was drawn includes companies in all manufacturing industries and, on the basis of earlier samples, a select number of nonmanufacturing industries known to conduct R&D.

The Standard Statistical Establishment List (SSEL), a Census compilation that contains information on 3.5 to 4 million establishments, was the universe frame used to select the 1987 sampling frame. Where necessary for multi-establishment companies, Census summed establishment-level data to the company level, and then assigned a single Standard Industrial Classification (SIC) code to that firm--the SIC code of the establishment(s) having the highest dollar-value of payroll.[4]

The weight given to an individual company is, in general, the inverse of the probability that the company would have been selected for inclusion in the sample. Certainty companies (for a detailed discussion, see **Frame Creation**) have a weight of 1.00. The company weight is retained both in the sampling year and in the years between samples. To minimize respondent burden, only the panel subset of the sample is canvassed between sample years. Most small firms are not re-contacted, but, in each succeeding year, Census estimates the data for each non-canvassed firm, based on the

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[3] The information presented in this section was provided by the Industry Division of the Bureau of the Census, the collecting and compiling agent for the National Science Foundation.

[4] Executive Office of the President, Office of Management and Budget, *Standard Industrial Classification Manual, 1972* (Washington, DC, Supt. of Documents, U.S. Government Printing Office).

Table B-1. Number of companies in the 1987 sample frame, 1987 sample, and 1990 panel

Page 1 of 2

	SIC code	1987 Sample frame	1987 Sample	1987 Certainty selection	1987 R&D performer	1990 Panel
Total		154,476	13,917	7,998	3,648	1,696
Manufacturing						
Total		64,237	6,656	4,090	2,875	1,397
Distribution by industry						
Food, kindred, and tobacco products	20,21	762	421	410	139	60
Textiles and apparel	22,23	2,582	466	446	117	42
Lumber, wood products, and furniture	24,25	1,518	234	213	93	40
Paper and allied products	26	1,103	172	144	81	39
Chemicals and allied products	28	6,630	315	242	200	146
Industrial chemicals	281-82,286	1,048	89	83	56	47
Drugs and medicines	283	854	69	60	46	36
Other chemicals	284-85,287-89	4,728	157	99	98	63
Petroleum refining and extraction	13,29	566	113	94	37	27
Rubber products	30	2,086	188	164	109	40
Stone, clay, and glass products	32	1,306	179	123	70	28
Primary metals	33	2,254	305	195	115	51
Ferrous metals and products	331-32,3398-99	1,188	144	116	52	23
Nonferrous metals and products	333-36	1,066	161	79	63	28
Fabricated metal products	34	10,046	503	276	210	64
Machinery	35	11,741	1,329	475	588	284
Office, computing, and accounting machines	357	1,707	150	136	121	99
Other machinery, except electrical	351-56,358-59	10 034	1,179	339	467	185
Electrical equipment	36	12,182	1,234	501	577	268
Radio and TV receiving equipment	365	650	58	24	17	5
Communication equipment	366	1,900	138	119	84	66
Electronic components	367	4,574	329	140	165	99
Other electrical equipment	361-64,369	5,058	709	218	311	98
Transportation equipment	37	498	289	211	156	121
Motor vehicles and motor vehicles equipment	371	159	99	98	64	37
Other transportation equipment	373-75,379	253	133	56	45	13
Aircraft and missiles	372,376	86	57	57	47	71

See explanatory information and SOURCE at end of table.

Table B-1. Number of companies in the 1987 sample frame, 1987 sample, and 1990 panel

Page 2 of 2

	SIC code	1987 Sample frame	1987 Sample	1987 Certainty selection	1987 R&D performer	1990 Panel
Professional and scientific instruments	38	5,800	453	180	274	142
Scientific and mechanical measuring instruments	381-82	2,363	268	87	160	74
Optical, surgical, photographic, and other instruments	383-87	3,437	185	93	114	68
Other manufacturing industries	27,31,39	5,163	455	416	109	41
Nonmanufacturing						
Total		90,239	7,261	3,903	789	299
Metal mining	10	23	22	22	10	5
Anthracite mining	11	72	25	25	- 4	2
Nonmetallic minerals, except fuels	14	79	30	10	10	4
General building contractors	15	3,157	185	150	11	2
Heavy construction contractors	16	1,963	140	89	11	4
Special trade contractors	17	433	139	129	11	1
Railroad transportation	40	27	21	21	5	3
Local and interurban passenger transit	41	96	41	29	0	0
Trucking & warehousing	42	314	142	141	3	2
Water transportation	44	88	54	50	3	0
Air transportation	45	112	65	63	3	2
Pipelines, except natural gas	46	19	12	8	1	0
Transportation services	47	77	42	33	1	1
Communication	48	2,880	115	88	23	17
Electric, gas & sanitary services	49	774	222	183	94	36
Wholesale trade - durable goods	50	685	274	270	40	22
Wholesale trade - nondurable goods	51				3	1
General merchandise stores	53	219	156	156	3	3
Food stores	54	594	309	307	10	2
Apparel & accessory stores	56	255	132	132	6	0
Banking	60	387	387	387	7	1
Security, commodity brokers & services	62	145	82	79	4	2
Insurance carriers	63	654	592	590	19	4
Personal services	72	75	34	33	5	2
Business services	73	3,541	329	303	35	25
Computer & data processing services	737	16,302	475	108	133	59
R&D laboratories, management and public relations, and commercial testing laboratories	7391,7392,7397	4,532	605	168	89	45
Motion pictures	78	98	24	21	4	0
Hospitals	806	23	23	23	2	0
Medical and dental laboratories	807	10,318	1,118	161	60	6
Engineering & architectural services	891	42,137	1,486	129	159	45

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

changes in the initial value of the R&D reported by the firm, and the average growth rate for the firm's industry.

Frame Creation

In selecting a sample frame from which to draw a sample of R&D-performing industries, NSF staff, given a finite budget for sample selection, make certain assumptions about industries to maximize sampling efficiency. That is, they apply a priori knowledge of industrial R&D activity to eliminate some industries from the possibility of selection by the initial SSEL sort and to designate other companies for sampling with 100 percent certainty. In addition, NSF staff made several innovations for the sample drawn in 1987 to improve its quality.

As in previous sample years, all companies that had been on the previous panel received a survey form. In addition, Census staff reviewed lists of R&D contractors published by the Department of Defense (DOD) and the National Aeronautics and Space Administration (NASA) to ensure that all their large industrial R&D-performing contractors were included in the sample with certainty.

From the outset, in the latest sample selection, the major goal was to eliminate from the sampling frame, to the greatest extent possible, companies unlikely to have R&D programs. This was done to minimize the number of companies chosen for the sample which had no R&D activity. To accomplish this objective, two steps were taken:

1. NSF staff narrowed the list of nonmanufacturing industries considered in-scope, by eliminating those likely to engage in little or no R&D activity. Thus, companies in the eliminated nonmanufacturing industries had no chance of being selected. This gave companies in the manufacturing industries and the remaining nonmanufacturing industries a greater probability of selection than they had in the past.

2. Companies below a certain employment size level--even in some in-scope industries--were eliminated from the universe frame. An assumption was made that, in some industries, companies with only a small number of employees are unlikely to engage in R&D activity. NSF staff provided an employment cutoff for each industry group. Generally, the cutoff in the selected industries was 250 employees, but hospitals were given an employment cutoff of 1,000 employees. Those companies with smaller employment levels were eliminated from the frame.

Further, all companies with more than 500 employees in the in-scope industries, except for hospitals that had a cutoff of 1,000 employees, were sampled with certainty.

To improve coverage of R&D-performing companies, NSF staff in 1987 provided to Census the names of firms, identified through media reports or other sources as R&D performers, that were to be included in the sample with certainty. Most of these companies, because they met other established criteria, would have received questionnaires anyway, but a few were added to the sample by this effort.

All certainty companies--those on lists provided by NSF staff, on lists of DOD and NASA contractors, companies with more than 500 employees, and previous panel members--are self-representing, i.e., they have sampling weights of unity.

Based on: (1) SIC code, (2) total employment cutoffs, (3) inclusion on an NSF, DOD, or NASA list, or (4) previous panel membership, approximately 154,000 companies were identified as in-scope of the survey and, therefore, included in the sampling frame. The new efforts to improve targeted coverage resulted in a sharp reduction in the size of the total in-scope universe from about 450,000 companies in 1981.

It is likely that a small number of companies actually engaged in R&D activity was omitted from the sampling frame as a result of these first-time sample selection operations. It was agreed, however, that the benefit from the new operations--greater sampling efficiency, resulting in improved national estimates of industrial R&D expenditures and employment--far outweighed the cost of the loss of a few companies that may have been eliminated from the in-scope sampling frame.

Probability Proportionate to Size

As with most types of economic surveys, the sample selection process for the industrial R&D survey used probabilities proportionate to size. That is, large companies have a proportionately higher probability of selection than do small companies, where large or small is measured relative to the statistic being estimated.

For the R&D survey, it would have been ideal if size could be determined by the amount of a company's R&D expenditures. Unfortunately, except for the companies that were in the current panel, it was impossible for Census to know the R&D expenditure values for firms in the universe frame. One logical solution was to estimate each company's R&D expenditures and base the probability of selection on the estimated values. This strategy had been employed in the 1981 sampling operation.

Clearly, this strategy has weaknesses. Even with the reduced number of in-scope industries in the sampling frame, many companies chosen for the frame may not have engaged in any R&D activity.

Nevertheless, the procedure used to estimate the size of companies was forced to treat all companies as if they did, in fact, perform R&D.

Census estimated the size of each company's R&D expenditures by using a relationship linking the size of its employment to its amount of R&D expenditures. [Since company employment was known for the universe, it was possible to use this relationship to estimate R&D expenditures values for all companies in the frame. Census derived this relationship for each SIC classification category, using data collected in the then most recent (1985) R&D survey]. Rather than treating all companies equally, the larger the number of employees in a company, the higher the probability of selection for inclusion in the sample. It was deemed reasonable to assume that large companies were more likely to have R&D programs than were small companies.

One further adjustment was introduced to the sample selection process. This was based on the assumption that multi-establishment companies would, on average, be expected to perform more R&D than single-establishment companies of the same size and in the same industry. The 1985 panel data were used to develop this adjustment factor. It should be noted that, for companies which were in the previous panel, the actual reported R&D activity was used and the data were not adjusted.

Sample Allocation and Relative Standard Error Constraints

The sampling program utilized for this operation allowed parameters to be assigned permitting the sample to be allocated across various levels, or strata, that correspond to industry groupings. This procedure permitted a desired sample size, or a desired sampling error, to be achieved for each stratum. Estimated errors of total R&D estimates for these strata were not to exceed certain levels. Since the amount of funds provided by NSF determined the size of the sample to be drawn, the only constraint in achieving these results was that the total sample size across all the strata could not exceed 12,000-13,000 companies. NSF staff provided relative rankings for each industry group--high, medium, or low--to determine the precision of the estimate. An actual translation to what high, medium, or low meant, specifically, could not be determined until Census staff arbitrarily investigated several sampling error levels, computed the sample size that these levels implied, and applied the constraint of the total sample size of 13,000. The result of this investigation led to the following criteria for the target sampling error of estimate of funds for R&D performance:

a. High precision: sampling error not to exceed 2 percent

b. Medium precision: sampling error not to exceed 5 percent

c. Low precision: sampling error not to exceed 10 percent

Based on the desired precision, these criteria suggested a total sample size of approximately 13,500. This number was not excessively beyond the stated limit of 13,000, so this was the sample size parameter chosen for the selection process.

One limitation should be noted. Sampling errors were controlled by using a universe total that, in large part, was improvised; that is, and as previously noted, Census assigned an R&D value to every company in the frame, even though many of these companies may not actually have had R&D expenditures. The value assigned was imputed for the great majority of companies in the frame, and, as a consequence, the estimated universe and the distribution of individual company values did not necessarily reflect reality. Estimates of sampling variability were nevertheless based on this distribution. The presumption was--and this had been confirmed in the previous sample selection--that actual variation in the sample design would be less than that estimated, because many of the sampled companies have true R&D values of zero, not the widely varying values that were imputed using total employment as a predictor of R&D. Thus, the 2 percent, 5 percent, and 10 percent error levels described earlier are conservative. [See Table B-2 for a complete list of the actual standard errors in the 1990 survey.]

The particular sample selected is one of a large number of the same type and size that, by chance, might have been selected. Estimates from each of the different samples would differ somewhat from each other and from the results of a complete canvass conducted under essentially the same conditions as the survey.

In addition to sampling error, the estimates are subject to nonsampling error that would also occur if a complete canvass were to be conducted under the same conditions.

Sample Selection

The sample selection program was run with a specified sample size (expected) of 13,500 and with other parameters set to ensure compliance with the relative standard error constraints. An actual sample of 13,917 was selected. The actual sample size differs from the specified for two reasons:

First, the program used independent sampling. Each company had an independent chance of selection, based on its assigned probability; the selection, or nonselection, of a company was completely independent of the selection of any other company.

Table B-2. Standard error of estimate (percentage) of funds for R&D performance for all company size-groups and for companies with fewer than 1,000 employees, by industry: 1990

Page 1 of 1

Industry	SIC code	Standard error 1/	Standard error of companies with fewer than 1,000 employees
Total		0.8	7.7
Food, kindred, and tobacco products	20,21	0.0	0.0
Textiles and apparel	22,23	8.2	48.4
Lumber, wood products, and furniture	24,25	0.6	5.8
Paper and allied products	26	4.6	41.0
Chemicals and allied products	28	3.2	42.9
Industrial chemicals	281-82,286	0.6	27.2
Drugs and medicines	283	0.8	24.5
Other chemicals	284-85,287-89	15.6	58.9
Petroleum refining and extraction	13,29	0.2	27.6
Rubber products	30	1.9	21.4
Stone, clay, and glass products	32	0.8	30.6
Primary metals	33	1.3	31.5
Ferrous metals and products	331-32,3398-99	4.1	52.8
Nonferrous metals and products	333-36	0.4	14.2
Fabricated metal products	34	5.8	23.2
Machinery	35	3.0	26.6
Office, computing, and accounting machines	357	3.6	46.2
Other machinery, except electrical	351-56,358-59	3.6	13.7
Electrical equipment	36	1.9	16.8
Radio and TV receiving equipment	365	7.4	26.5
Communication equipment	366	2.6	45.1
Electronic components	367	4.3	22.7
Other electrical equipment	361-64,369	2.2	15.8
Transportation equipment	37	0.1	31.0
Motor vehicles and motor vehicles equipment	371	0.4	69.1
Other transportation equipment	373-75,379	1.6	24.8
Aircraft and missiles	2	0.0	0.0
Professional and scientific instruments	38	1.2	9.1
Scientific and mechanical measuring instruments	381-82	2.2	10.4
Optical, surgical, photographic, and other instruments	383-87	1.4	15.9
Other manufacturing industries	27,31,39	1.8	15.9
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,76,806-07,87	4.1	8.8

1/ A description of the standard error of estimate is given in Section B under "Survey Methodology." The percentage (or relative) standard errors in this table may be converted to standard errors of estimate by multiplying the percentages shown by the associated estimates. For example, the relative standard error of estimate for R&D performance for all company size groups in the chemicals industry (SIC 28) is shown as 3.2 percent, and the associated total R&D estimate for this industry is shown as $12,565 million in Table A-3, "Total (company and Federal) funds for industrial R&D performance by industry and size of company: 1980-90." The standard error of estimate, then, is .032 times 12,565 or 402.8.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

In independent sampling, sample size is, itself, a random variable. Theoretically, a sample of size zero or a sample the size of the entire universe is possible, but the probabilities of these extremes are so small that these are nearly impossible situations. The actual sample size is usually quite close to the specified size. If there is too much deviation, the program is simply executed again.

Second, a minimum probability rule was imposed. As noted earlier, the sampling program assigns probabilities proportionate to size (where size in this case is the imputed R&D value assigned each company). Selected companies that have R&D programs vastly larger than their assigned values can have adverse effects on the estimates, once the data are collected. To lessen these effects, the maximum weight a company can assume was arbitrarily controlled by specifying that the probability of selection cannot be less than a certain value. If the probability, based on its size, is less than this minimum value, then it is set equal to this value. The consequence of raising these original probabilities to the minimum probability is to raise the expected sample size. It is likely that most of the difference between the specified sample size and the actual sample size is due to this rule.

The Annual Panel

The panel is a group of companies that receive a survey questionnaire, Form RD-1, annually. The following is a description of how the present panel was formed from the new sample in 1987.

The basic tool for the survey is Form RD-1, which is used to collect detailed R&D information. The 1,095 companies that were in the old panel and had received a 1986 RD-1 form received an RD-1 form for 1987. The remaining certainty companies (6,903) and noncertainty companies (5,919) in the new sample received an RD-1A survey form for 1987. Form RD-1A is an abbreviated version of RD-1 and is, generally, mailed to companies only in the year in which a new sample is drawn. The purpose is to canvass smaller R&D performers but to impose a minimum of reporting burden on them.

Of the 13,917 companies that received a form in 1987, 3,648 respondents reported that their companies were R&D performers or were identified as R&D performers based on information from other sources. The 3,648 companies were ranked by total R&D funds (both Federal and company and other) within each SIC code. All companies with over $1 million in total R&D expenditures were placed on the RD-1 panel. In some industries Census added to the panel companies with less than $1 million in R&D expenditures, in an attempt to ensure 95 percent coverage of the R&D total for each industry.

The result of this process was an increase of panel size from 1,095 companies based on the previous sample to 1,742 companies based on the sample drawn in 1987. All companies selected for the panel will receive the RD-1 questionnaire annually, until the next sample is drawn. The other companies will not receive another questionnaire; their R&D data will be estimated, in subsequent years, by Census staff, using their 1987 reports as a base.

Followup for Survey Nonresponse

The 1990 survey questionnaires were mailed in March 1991, and recipients were asked to respond within 60 days. Thirty days later, letters were mailed to all survey recipients, reminding them that their completed questionnaire was due within the next 30 days. At 60 days, an initial set of followup letters was sent to all nonresponding firms. Two additional followup mailings were made to persistent nonrespondents, at 90 and 120 days. The 90-day followup mailing included a replacement questionnaire.

The followup strategy and materials used for the 1990 survey cycle differed from that used in earlier years in three ways: (1) the introduction of the 30-day reminder letter; (2) the elimination of Form MA-121, which had been used, previously, to request only the mandatory data items from persistent nonrespondents; and (3) letters were sent in packaged pairs, one from NSF and one from Census.

In addition to the followup mailings, telephone followup was used to encourage response among those nonresponding firms ranked among the 200 largest R&D performers, based on 1989 expenditures. Telephone followup was also used for these firms during the initial data edit phase of survey operations.

Imputation for Item Nonresponse

Even when forms are returned, they are often incomplete. Many firms choose to return the survey forms with one or more items blank, for varying reasons--for instance, the internal accounting procedures of the firm may not allow it to quantify R&D by, say, pollution-abatement expenditures. In addition, some firms, as a matter of policy, refuse to answer any voluntary questions. Four data items on the RD-1 questionnaire (total R&D expenditures, Federal R&D funds, net sales, and total employment), however, are included in Census' mandatory statistical program. The response rate for these mandatory items was significantly higher than for the other items on the survey.

When respondents do not provide the requested information, Census estimates the missing data for each firm, using an imputation algorithm. In general, the imputation algorithms employed by Census compute values for missing items by applying the average percentage change for the target item in the nonresponding firm's industry to the item's prior year value for that firm, reported or imputed. This approach, with minor variation, is used for most items on the survey form. Note that all items for nonpanel firms--that is, firms that are surveyed in the sample year, but, which because of size, are not surveyed again until a new sample is selected--are estimated in the nonsample years, using these imputation processes.

Table B-3 contains imputation rates for the principal survey items. For a detailed discussion of the problems stemming from item nonresponse, see the Technical Report, Estimating Basic and Applied Research and Development in Industry: A Preliminary Review of Survey Procedures, NSF 90-322.

There are two survey items that do not use this general imputation methodology: (1) geographic distribution of R&D expenditures, and (2) R&D expenditures distributed by basic research, applied research, and development (character-of-work).

The imputation method for computing estimates of the geographic distribution of R&D expenditures was revised in 1989 to include the use of secondary source information as well as focused telephone followup. The secondary source used is the Directory of American Research and Technology 1990, R.R. Bowker, New York, which lists the locations of R&D laboratories for over 6,700 firms in the U.S. R&D expenditures for nonresponding firms listed in this directory as having laboratories in only a single State were assigned to that State. The remaining nonresponding firms were contacted by telephone and asked to distribute their reported R&D expenditures; most were able to provide this information. This modified approach is used only for nonresponding firms ranked among the 200 largest R&D performers. The imputation rates listed in Table B-3 reflect gains made using this method.

The imputation procedure used for the basic research, applied research, and development expenditure estimates was revised in 1987 for use with 1986 and later data and also differs from the general imputation approach.

Response to character-of-work items has been declining in recent years and, as a result, their imputation rates have been increasing. The general imputation procedure became increasingly dependent upon information that had been imputed in prior years, thereby distancing current-year distribution estimates from the time at which they were reported. In addition, to reduce the reporting burden of this survey, smaller, nonpanel firms in the sample have never been asked to disaggregate their R&D expenditures into character-of-work categories; consequently, imputation is required for all such firms.

Table B-3. Imputation rates for selected items on the research and development survey, by industry: 1990

[Percent]

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Industry	SIC code	Net sales	Total employment	R&D scientists/ engineers	Total R&D: Total	Total R&D: Company	Total R&D: Federal	Energy R&D	Pollution abatement R&D	Foreign R&D
Total		28.6	37.1	39.6	7.1	14.1	2.1	11.9	39.4	6.5
Food, kindred, and tobacco products	20,21	44.2	50.2	50.0	17.8	26.4	0.0	0.0	14.6	28.3
Textiles and apparel	22,23	56.0	60.8	74.3	43.2	54.5	0.0	0.0	0.0	0.0
Lumber, wood products, and furniture	24,25	47.2	54.7	71.9	19.5	29.1	-	97.5	0.0	0.0
Paper and allied products	26	21.5	27.5	50.5	14.6	20.1	-	1.9	1.5	2.2
Chemicals and allied products	28	12.1	18.4	41.8	9.4	20.1	8.7	4.6	30.8	14.2
Industrial chemicals	281-82,286	3.4	3.9	57.4	1.4	1.9	7.3	4.6	52.5	5.2
Drugs and medicines	283	11.2	12.5	35.7	7.2	30.1	36.1	0.0	62.9	14.0
Other chemicals	284-85,287-89	25.4	41.1	34.9	28.0	28.6	0.0	0.0	0.0	23.6
Petroleum refining and extraction	13,29	9.5	8.0	29.7	0.4	25.6	69.8	26.2	0.9	8.6
Rubber products	30	35.4	57.3	73.2	16.9	19.7	0.0	0.0	45.0	0.9
Stone, clay, and glass products	32	23.7	22.3	18.4	3.0	3.6	0.0	0.0	2.3	5.9
Primary metals	33	30.3	39.1	64.6	19.7	32.3	4.0	0.7	16.6	7.2
Ferrous metals and products	331-32,3398-99	29.7	43.8	70.0	9.8	33.4	24.6	0.0	0.0	0.0
Nonferrous metals and products	333-36	31.1	34.3	61.0	23.9	31.8	2.6	8.1	21.0	7.2
Fabricated metal products	34	60.5	63.9	59.7	17.0	32.3	0.4	1.9	0.0	0.0
Machinery	35	22.2	27.0	22.7	8.2	10.1	0.3	19.3	9.0	0.8
Office, computing, and accounting machines	357	6.7	9.4	17.6	5.0	6.4	0.0	-	-	0.3
Other machinery, except electrical	351-56,358-59	34.1	40.8	40.1	21.2	24.9	2.3	19.3	9.0	4.4
Electrical equipment	36	15.3	16.8	45.9	4.9	9.8	2.3	23.1	6.1	7.4
Radio and TV receiving equipment	365	49.8	32.4	17.1	22.1	22.1	-	-	-	0.0
Communication equipment	366	7.3	5.9	37.8	1.7	3.4	0.1	5.1	16.2	3.0
Electronic components	367	17.6	22.4	52.5	7.1	11.4	16.4	90.7	0.0	4.5
Other electrical equipment	361-64,369	23.9	28.7	59.6	9.7	25.6	0.1	2.8	0.0	23.3
Transportation equipment	37	6.0	6.5	21.3	0.4	1.7	0.1	17.1	57.1	0.3
Motor vehicles and motor vehicles equipment	371	8.9	11.4	38.0	0.8	1.6	0.3	98.4	85.1	0.3
Other transportation equipment	373-75,379	20.1	17.0	82.4	5.3	6.7	0.0	0.0	0.0	0.0
Aircraft and missiles	372,376	1.3	1.7	12.6	0.1	1.5	0.1	14.9	8.6	0.0

See explanatory information and SOURCE at end of table.

Table B-3. Imputation rates for selected items on the research and development survey, by industry: 1990

[Percent]

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Industry	SIC code	Net sales	Total employment	R&D scientists/ engineers	Total R&D			Energy R&D	Pollution abatement R&D	Foreign R&D
					Total	Company	Federal			
Professional and scientific instruments......	38	17.9	22.2	77.4	9.1	12.1	9.8	26.1	0.0	12.5
Scientific and mechanical measuring instruments..	381-82	23.9	31.6	77.2	12.4	18.1	99.7	19.8	0.0	1.6
Optical, surgical, photographic, and other instruments....................................	383-87	15.6	17.2	77.7	7.4	9.0	0.0	75.5	0.0	13.0
Other manufacturing industries..................	21,27,31,39	39.4	41.4	69.0	21.8	23.3	0.0	4.2	21.3	13.5
Nonmanufacturing industries.....................	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	50.2	63.7	54.6	25.7	36.7	17.3	30.9	54.2	27.5

- Represents no basis for imputation

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Because of the increasing dependence on imputed data, NSF chose not to publish estimates of industrial basic research, applied research, and development in this report, beginning in 1986.

In 1987, Census revised its approach for imputing character-of-work estimates. The revised method calculates the character-of-work distribution for a nonresponding firm only if that firm reported a distribution within a 5-year time period, extending from 2 years before to 2 years after the year requiring imputation. Imputation for a given year is initially performed in the year the data are collected and is based on a character-of-work distribution reported in either of the 2 previous years, if any. It is again performed using new data collected in the next 2 years. Thus, character-of-work estimates are revised as newly reported information becomes available and are not final for 2 years following their initial publication. This revised imputation procedure was first used for the 1986 estimates.

If reported data are not available for a firm, Census does not impute a character-of-work distribution for that firm. As a consequence of this restriction, only approximately 70 percent of the total estimated R&D expenditures were distributed across these categories in the 1986 Census estimates. Those expenditures not meeting the requirements of the new imputation methodology were placed in the newly created "Not distributed" category.

Tables B-4 through B-6 show the current character-of-work estimates provided by Census along with the "Not distributed" component for 1988, 1989, and 1990.

NSF's objective in this survey is to provide estimates for the entire population of firms performing R&D in the U.S. As the revised Census imputation procedure no longer produces such estimates (because of the "Not distributed" component) this objective is no longer being met for character-of-work estimates. NSF sought alternative methods.

A separate NSF Technical Report, Estimating Basic and Applied Research and Development in Industry: A Preliminary Review of Survey Procedures, NSF 90-322, presents character-of-work estimates for 1986, 1987, and 1988 and examines several alternative approaches to apportioning the "Not distributed" data to the basic research, applied research, and development categories. The tables in the report illustrate how estimated figures for basic research, applied research, and development can vary, depending on assumptions made about the R&D expenditures that are not distributed by Census. Explanations of the assumptions underlying different estimates are provided, along with an overview of the Survey of Industrial Research and Development and an explanation of some general problems of missing information.

Table B-4. Funds distributed for basic research, applied research, and development, by industry and size of company, by source of funds: 1988

[Dollars in millions]

		Distributed funds											
		Total			Basic			Applied			Development		
Distribution by industry	SIC code	Total	Federal	Company	Total	Federal	Company	Total	Federal	Company	Total	Federal	Company
Total		$97,889	$32,117	$65,772	$2,835	$668	$2,227	$14,780	$3,354	$11,426	$53,303	$20,217	$33,086
Food, kindred, and tobacco products	20,21	(D)	(D)	1,192	(D)	0	(D)	(D)	0	(D)	(D)	(D)	558
Textiles and apparel	22,23	(D)	(D)	210	(D)	0	(D)	(D)	0	(D)	(D)	(D)	92
Lumber, wood products, and furniture	24,25	(D)	(D)	156	(D)	(D)	(S)	35	0	35	(D)	(D)	57
Paper and allied products	26	(D)	(D)	664	31	0	(S)	(D)	(D)	143	226	0	226
Chemicals and allied products	28	10,772	199	10,573	548	12	536	3,000	106	2,894	4,100	78	4,022
Industrial chemicals	281-82,286	3,959	196	3,763	213	12	201	(D)	(D)	1,023	(D)	(D)	1,428
Drugs and medicines	283	4,746	3	4,743	(S)	0	(S)	(D)	(D)	1,245	(D)	(D)	1,480
Other chemicals	284-85,287-89	2,067	0	2,067	29	0	29	626	0	626	1,114	0	1,114
Petroleum refining and extraction	13,29	1,944	21	1,923	(D)	(D)	53	(D)	(D)	686	604	6	598
Rubber products	30	(D)	(D)	635	20	0	20	(D)	(D)	45	(D)	(D)	155
Stone, clay, and glass products	32	(D)	(D)	826	150	0	150	(D)	(D)	(S)	210	0	210
Primary metals	33	663	21	642	69	0	69	(D)	(D)	161	(D)	(D)	257
Ferrous metals and products	331-32,3398-99	258	1	257	2	0	2	(D)	(D)	71	(D)	(D)	71
Nonferrous metals and products	333-36	405	20	385	67	0	67	(D)	(D)	90	(D)	(D)	186
Fabricated metal products	34	829	142	687	29	0	29	(D)	(D)	85	(D)	(D)	248
Machinery	35	(D)	(D)	11,992	(D)	(D)	195	(D)	(D)	1,692	(D)	(D)	8,023
Office, computing, and accounting machines	357	(D)	(D)	9,371	(D)	(D)	144	(D)	(D)	1,393	(D)	(D)	6,708
Other machinery, except electrical	351-56,358-59	2,719	98	2,621	(S)	0	(S)	(D)	(D)	299	(D)	(D)	1,315
Electrical equipment	36	16,242	5,181	11,061	430	21	409	2,767	623	2,144	9,275	3,431	5,844
Radio and TV receiving equipment	365	139	0	139	(D)	0	(D)	(D)	0	(D)	(D)	0	(D)
Communication equipment	366	10,296	4,621	5,675	(D)	(D)	(D)	(D)	(D)	689	7,141	(D)	(D)
Electronic components	367	4,607	539	4,068	(D)	(D)	(D)	1,466	(D)	(D)	(D)	(D)	1,415
Other electrical equipment	361-64,369	1,200	21	1,179	(S)	0	(S)	114	0	114	465	10	455
Transportation equipment	37	36,338	22,176	14,162	351	197	154	2,854	1,531	1,323	23,277	14,592	8,685
Motor vehicles and motor vehicles equipment	371	(D)	(D)	7,769	70	0	70	(D)	(D)	(D)	(D)	(D)	(D)
Other transportation equipment	373-75,379	(D)	(D)	370	(S)	0	(S)	(D)	(D)	(D)	(D)	(D)	(D)
Aircraft and missiles	372,376	25,900	19,877	6,023	276	197	79	2,262	1,437	825	16,971	13,282	3,689

See explanatory information and SOURCE at end of table.

Table B-4. Funds distributed for basic research, applied research, and development, by industry and size of company, by source of funds: 1988

[Dollars in millions]

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Distribution by industry	SIC code	Total: Total	Total: Federal	Total: Company	Basic: Total	Basic: Federal	Basic: Company	Applied: Total	Applied: Federal	Applied: Company	Development: Total	Development: Federal	Development: Company
Professional and scientific instruments	38	$5,426	$120	$5,306	(D)	(D)	$221	(D)	(D)	$547	$1,734	$80	$1,654
Scientific and mechanical measuring instruments	381-82	1,734	(S)	1,710	35	0	35	(D)	(D)	62	(D)	(D)	278
Optical, surgical, photographic, and other instruments	383-87	3,692	96	3,596	(D)	(D)	186	(D)	(D)	485	(D)	(D)	1,376
Other manufacturing industries	27,31,39	(D)	(D)	383	(S)	0	(S)	44	0	44	229	0	229
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	8,113	2,753	5,360	685	429	256	1,473	589	884	3,200	971	2,229
Distribution by size of company [Based on number of employees]													
Less than 500		(S)	863	(S)	454	(S)	319	1,172	242	930	2,688	127	2,561
500 to 999		1,656	139	1,517	(D)	(D)	(S)	(D)	(D)	245	962	35	927
1,000 to 4,999		7,598	1,157	6,441	378	51	327	1,143	156	987	2,876	(S)	2,270
5,000 to 9,999		5,236	914	4,322	(D)	(D)	206	(D)	(D)	977	2,918	(S)	2,348
10,000 to 24,999		11,473	1,805	9,668	(D)	(D)	(S)	(D)	(D)	2,684	5,490	1,058	4,432
25,000 or more		64,677	27,239	37,438	1,337	475	962	8,259	2,656	5,603	38,369	17,821	20,548

Distribution by industry	SIC code	Not Distributed: Total	Not Distributed: Federal	Not Distributed: Company	Percent of Total Not Distributed: Total	Percent of Total Not Distributed: Federal	Percent of Total Not Distributed: Company
Total		$26,911	$7,878	$19,033	27.5%	24.5%	28.9%
Food, kindred, and tobacco products	20,21	272	0	272	(D)	0.0%	22.8%
Textiles and apparel	22,23	(D)	(D)	99	(D)	(D)	47.1%
Lumber, wood products, and furniture	24,25	47	0	47	(D)	0.0%	30.1%
Paper and allied products	26	264	0	264	(D)	0.0%	39.8%
Chemicals and allied products	28	3,124	3	3,121	29.0%	1.5%	29.5%
Industrial chemicals	281-82,286	1,112	1	1,111	28.1%	0.5%	29.5%
Drugs and medicines	283	1,714	2	1,712	36.1%	66.7%	36.1%
Other chemicals	284-85,287-89	298	0	298	14.4%	0.0%	14.4%
Petroleum refining and extraction	13,29	597	11	586	30.7%	52.4%	30.5%
Rubber products	30	415	0	415	(D)	0.0%	65.4%
Stone, clay, and glass products	32	68	0	68	(D)	0.0%	8.2%
Primary metals	33	156	1	155	23.5%	4.8%	24.1%
Ferrous metals and products	331-32,3398-99	113	0	113	43.8%	0.0%	44.0%
Nonferrous metals and products	333-36	43	1	42	10.6%	5.0%	10.9%

See explanatory information and SOURCE at end of table.

Table B-4. Funds distributed for basic research, applied research, and development, by industry and size of company, by source of funds: 1988

[Dollars in millions]

		Not Distributed			Percent of Total Not Distributed		
Distribution by industry	SIC code	Total	Federal	Company	Total	Federal	Company
Fabricated metal products	34	$373	$48	$325	45.0%	33.8%	47.3%
Machinery	35	2,152	70	2,082	(D)	(D)	17.4%
Office, computing, and accounting machines	357	1,126	0	1,126	(D)	0.0%	12.0%
Other machinery, except electrical	351-56,358-59	1,026	70	956	37.7%	71.4%	36.5%
Electrical equipment	36	3,770	1,106	2,664	23.2%	21.3%	24.1%
Radio and TV receiving equipment	365	127	0	127	91.4%	0.0%	91.4%
Communication equipment	366	1,722	934	788	16.7%	20.2%	13.9%
Electronic components	367	1,381	161	1,220	30.0%	29.9%	30.0%
Other electrical equipment	361-64,369	540	11	529	45.0%	52.4%	44.9%
Transportation equipment	37	9,856	5,856	4,000	27.1%	26.4%	28.2%
Motor vehicles and motor vehicles equipment	371	3,159	773	2,386	(D)	(D)	30.7%
Other transportation equipment	373-75,379	306	122	184	(D)	(D)	49.7%
Aircraft and missiles	372,376	6,391	4,961	1,430	24.7%	25.0%	23.7%
Professional and scientific instruments	38	2,898	14	2,884	53.4%	11.7%	54.4%
Scientific and mechanical measuring instruments	381-82	1,340	5	1,335	77.3%	20.8%	78.1%
Optical, surgical, photographic, and other instruments	383-87	1,558	9	1,549	42.2%	9.4%	43.1%
Other manufacturing industries	27,31,39	(D)	(D)	63	(D)	(D)	16.4%
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	2,755	764	1,991	34.0%	27.8%	37.1%
Distribution by size of company [Based on number of employees]							
Less than 500		2,935	359	2,576	40.5%	40.3%	40.3%
500 to 999		363	79	284	21.9%	56.8%	18.7%
1,000 to 4,999		3,201	344	2,857	42.1%	29.7%	44.4%
5,000 to 9,999		1,093	302	791	20.9%	33.0%	18.3%
10,000 to 24,999		2,607	507	2,100	22.7%	28.1%	21.7%
25,000 or more		16,712	6,287	10,325	25.8%	23.1%	27.6%

(D) Data have been withheld to avoid disclosing operations of individual companies.
(S) Data have been withheld due to imputation of more than 50 percent.

NOTE: Character-of-work data in this table represent only that fraction of total R&D funds for which there was a reported basis for distribution--they DO NOT represent universe estimates. The "Not Distributed" column shows those funds for which there was no basis for distribution.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table B-5. Funds distributed for basic research, applied research, and development, by industry and size class, by source of funds: 1989

[Dollars in millions]

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Distribution by industry	SIC code	Total			Distributed funds								
					Basic			Applied			Development		
		Total	Federal	Company	Total	Federal	Company	Total	Federal	Company	Total	Federal	Company
Total		$101,854	$31,292	$70,562	$3,788	$913	$2,875	$16,189	$3,729	$12,460	$54,930	$18,342	$36,588
Food, kindred, and tobacco products	20,21	(D)	(D)	1,284	24	0	24	(D)	(D)	368	(D)	(D)	606
Textiles and apparel	22,23	(D)	(D)	(S)	(D)	0	(D)	(D)	0	(D)	(D)	(D)	77
Lumber, wood products, and furniture	24,25	172	0	172	(D)	0	(D)	(D)	0	(D)	57	0	57
Paper and allied products	26	686	0	686	27	0	27	114	0	114	262	0	262
Chemicals and allied products	28	11,466	83	11,383	545	8	537	3,174	7	3,167	4,251	34	4,217
Industrial chemicals	281-82,286	4,039	79	3,960	231	8	223	(D)	(D)	1,062	(D)	(D)	1,453
Drugs and medicines	283	(D)	(D)	5,164	(S)	0	(S)	(D)	(D)	1,358	(D)	(D)	1,609
Other chemicals	284-85,287-89	(D)	(D)	2,259	39	0	39	(D)	(D)	747	(D)	(D)	1,155
Petroleum refining and extraction	13,29	2,066	(S)	2,050	(D)	(D)	72	(D)	(D)	671	673	3	670
Rubber products	30	(D)	(D)	678	17	0	17	(D)	(D)	44	(D)	(D)	168
Stone, clay, and glass products	32	(D)	(D)	864	(D)	(D)	169	(D)	(D)	390	(D)	(D)	237
Primary metals	33	749	34	715	78	0	78	(D)	(D)	174	(D)	(D)	295
Ferrous metals and products	331-32,3398-99	(D)	(D)	254	(D)	0	(D)	(D)	(D)	(D)	(D)	(D)	68
Nonferrous metals and products	333-36	(D)	(D)	461	(D)	0	(D)	(D)	(D)	(D)	(D)	(D)	227
Fabricated metal products	34	800	136	664	23	0	23	(D)	(D)	90	(D)	(D)	224
Machinery	35	14,635	1,157	13,478	(D)	(D)	212	(D)	(D)	2,302	(D)	(D)	(S)
Office, computing, and accounting machines	357	(D)	(D)	10,780	(D)	(D)	151	(D)	(D)	1,964	(D)	(D)	(S)
Other machinery, except electrical	351-56,358-59	(D)	(D)	2,698	61	0	61	(D)	(D)	338	1,502	18	1,484
Electrical equipment	36	16,929	5,288	11,641	376	21	355	3,125	(S)	2,114	9,507	3,025	6,482
Radio and TV receiving equipment	365	84	0	84	(D)	0	(D)	2	0	2	(D)	0	(D)
Communication equipment	366	10,539	4,719	5,820	(D)	(D)	(D)	(D)	(D)	(D)	7,014	2,767	4,247
Electronic components	367	(D)	(D)	4,458	(D)	(D)	39	(D)	(D)	1,411	(D)	(D)	1,680
Other electrical equipment	361-64,369	(D)	(D)	1,279	(S)	0	(S)	(D)	0	(D)	558	(D)	(D)
Transportation equipment	37	36,844	21,761	15,083	557	393	164	(D)	(D)	1,401	(D)	(D)	9,782
Motor vehicles and motor vehicles equipment	371	(D)	(D)	8,725	(D)	0	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Other transportation equipment	373-75,379	(D)	(D)	353	(D)	0	(D)	(D)	0	(D)	(D)	(D)	(D)
Aircraft and missiles	372,376	25,638	19,633	6,005	492	393	99	2,362	1,542	820	16,656	12,431	4,225

See explanatory information and SOURCE at end of table.

Table B-5. Funds distributed for basic research, applied research, and development, by industry and size class, by source of funds: 1989

[Dollars in millions]

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Distribution by industry	SIC code	Total			Basic			Applied			Development		
		Total	Federal	Company	Total	Federal	Company	Total	Federal	Company	Total	Federal	Company
Professional and scientific instruments	38	$5,743	$113	$5,630	(D)	(D)	$211	$667	$21	$646	(D)	(D)	$1,778
Scientific and mechanical measuring instruments	381-82	1,868	(S)	1,858	(S)	0	(S)	(D)	(D)	(S)	278	0	278
Optical, surgical, photographic, and other instruments	383-87	3,875	103	3,772	(D)	(D)	186	(D)	(D)	519	(D)	(D)	1,500
Other manufacturing industries	27,31,39	(D)	(D)	400	(S)	0	(S)	49	0	49	237	0	237
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	8,286	2,666	5,620	1,376	475	901	1,498	623	875	3,359	843	2,516
Distribution by size of company [Based on number of employees]													
Less than 500		7,620	987	(S)	946	147	799	666	254	412	2,454	73	2,381
500 to 999		1,765	105	1,660	(D)	(D)	164	(D)	(D)	234	768	(S)	736
1,000 to 4,999		7,696	1,050	6,646	(D)	(D)	351	(D)	(D)	1,352	3,992	467	3,525
5,000 to 9,999		5,626	811	4,815	(D)	(D)	158	(D)	(D)	1,154	2,757	498	2,259
10,000 to 24,999		10,185	1,237	8,948	(D)	(D)	(S)	(D)	(D)	2,782	4,643	(S)	4,192
25,000 or more		68,962	27,102	41,860	1,521	613	908	9,059	2,533	6,526	40,316	16,821	23,495

Distribution by industry	SIC code	Not Distributed			Percent of Total Not Distributed		
		Total	Federal	Company	Total	Federal	Company
Total		$26,947	$8,308	$18,639	26.5%	26.5%	26.4%
Food, kindred, and tobacco products	20,21	286	0	286	(D)	0.0%	22.3%
Textiles and apparel	22,23	112	0	112	(D)	0.0%	52.0%
Lumber, wood products, and furniture	24,25	55	0	55	32.0%	0.0%	32.0%
Paper and allied products	26	283	0	283	41.3%	0.0%	41.3%
Chemicals and allied products	28	3,496	34	3,462	30.5%	41.0%	30.4%
Industrial chemicals	281-82,286	1,254	32	1,222	31.0%	40.5%	30.9%
Drugs and medicines	283	1,924	2	1,922	(D)	(D)	37.2%
Other chemicals	284-85,287-89	318	0	318	(D)	0.0	14.1%
Petroleum refining and extraction	13,29	(D)	(D)	637	(D)	(D)	31.1%
Rubber products	30	449	0	449	(D)	0.0	66.2%
Stone, clay, and glass products	32	68	0	68	(D)	0.0	7.9%
Primary metals	33	169	1	168	22.6%	2.9%	23.5%
Ferrous metals and products	331-32,3398-99	121	0	121	(D)	0.0%	47.6%
Nonferrous metals and products	333-36	48	1	47	(D)	(D)	10.2%

See explanatory information and SOURCE at end of table.

Table B-5. Funds distributed for basic research, applied research, and development, by industry and size class, by source of funds: 1969

[Dollars in millions]

Distribution by industry	SIC code	Not Distributed			Percent of Total Not Distributed		
		Total	Federal	Company	Total	Federal	Company
Fabricated metal products	34	$383	$56	$327	47.9%	41.2%	49.2%
Machinery	35	2,103	119	1,984	14.4%	10.3%	14.7%
Office, computing, and accounting machines	357	1,206	37	1,169	(D)	(D)	10.8%
Other machinery, except electrical	351-56,358-59	897	82	815	(D)	(D)	30.2%
Electrical equipment	36	3,921	1,231	2,690	23.2%	23.3%	23.1%
Radio and TV receiving equipment	365	71	0	71	84.5%	0.0%	84.5%
Communication equipment	366	1,814	1,043	771	17.2%	22.1%	13.2%
Electronic components	367	1,489	161	1,328	(D)	(D)	29.8%
Other electrical equipment	361-64,369	547	27	520	(D)	(D)	40.7%
Transportation equipment	37	9,853	6,117	3,736	26.7%	28.1%	24.8%
Motor vehicles and motor vehicles equipment	371	3,491	798	2,693	(D)	(D)	30.9%
Other transportation equipment	373-75,379	234	52	182	(D)	(D)	51.6%
Aircraft and missiles	372,376	6,128	5,267	861	23.9%	26.8%	14.3%
Professional and scientific instruments	38	$3,007	$12	$2,995	52.4%	10.6%	53.2%
Scientific and mechanical measuring instruments	381-82	(D)	(D)	1,428	(D)	(D)	76.9%
Optical, surgical, photographic, and other instruments	383-87	(D)	(D)	1,567	(D)	(D)	41.5%
Other manufacturing industries	27,31,39	(D)	(D)	56	(D)	100.0%	14.0%
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	2,053	725	1,328	24.8%	27.2%	23.6%

Distribution by size of company [Based on number of employees]	Total	Federal	Company	Total	Federal	Company
Less than 500	3,554	513	3,041	48.6%	52.0%	45.8%
500 to 999	597	71	526	33.8%	67.8%	31.7%
1,000 to 4,999	1,701	283	1,418	22.1%	27.9%	21.3%
5,000 to 9,999	1,351	107	1,244	24.0%	13.2%	25.8%
10,000 to 24,999	1,678	199	1,479	16.3%	16.1%	16.5%
25,000 or more	18,066	7,135	10,931	26.2%	26.3%	26.1%

(D) Data have been withheld to avoid disclosing operations of individual companies.
(S) Data have been withheld due to imputation of more than 50 percent.

NOTE: Character-of-work data in this table represent only that fraction of total R&D funds for which there was a reported basis for distribution--they DO NOT represent universe estimates. The "Not Distributed" column show those funds for which there was no basis for distribution.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table B-6. Funds distributed for basic research, applied research, and development, by industry and size of company, by source of funds: 1990

[Dollars in millions]

Page 1 of 3

Distribution by industry	SIC code	Total			Distributed funds								
					Basic			Applied			Development		
		Total	Federal	Company	Total	Federal	Company	Total	Federal	Company	Total	Federal	Company
Total		$104,344	$30,580	$73,764	$3,362	$940	$2,422	$18,244	$4,051	$14,193	$58,485	$18,049	$40,436
Food, kindred, and tobacco products	20,21	(D)	(D)	1,376	35	0	35	414	0	414	653	0	653
Textiles and apparel	22,23	(D)	(D)	227	(D)	0	(D)	(S)	0	(S)	(D)	(D)	(D)
Lumber, wood products, and furniture	24,25	180	0	180	(D)	0	(D)	(D)	0	(D)	75	0	75
Paper and allied products	26	736	0	736	21	0	21	136	0	136	366	0	366
Chemicals and allied products	28	12,565	67	12,498	539	(S)	537	3,837	6	3,831	4,776	22	4,754
Industrial chemicals	281-82,286	4,344	64	4,280	213	(S)	210	(D)	(D)	1,300	(D)	(D)	1,522
Drugs and medicines	283	(D)	(D)	5,651	(S)	0	(S)	(D)	(D)	1,567	(D)	(D)	1,785
Other chemicals	284-85,287-89	(D)	(D)	2,567	48	0	48	(D)	(D)	(S)	1,447	0	1,447
Petroleum refining and extraction	13,29	2,099	16	2,083	(D)	(D)	87	698	1	697	(D)	(D)	753
Rubber products	30	(D)	(D)	732	(S)	0	(S)	(D)	(D)	90	(D)	(D)	182
Stone, clay, and glass products	32	(D)	(D)	893	(D)	(D)	190	(D)	(D)	406	(D)	(D)	247
Primary metals	33	(D)	(D)	774	(S)	0	(S)	(D)	(D)	(D)	(D)	(D)	(D)
Ferrous metals and products	331-32,3398-99	(D)	(D)	240	(D)	0	(D)	(D)	(D)	(D)	(D)	(D)	65
Nonferrous metals and products	333-36	(D)	(D)	534	(D)	0	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Fabricated metal products	34	808	133	675	23	0	23	(D)	(D)	120	(D)	(D)	309
Machinery	35	14,700	896	13,804	(D)	(D)	207	(D)	(D)	2,159	(D)	(D)	9,916
Office, computing, and accounting machines	357	(D)	(D)	11,050	(D)	(D)	157	(D)	(D)	1,752	(D)	(D)	8,026
Other machinery, except electrical	351-56,358-59	(D)	(D)	2,754	(S)	0	(S)	(D)	(D)	407	(D)	(D)	1,890
Electrical equipment	8	17,397	5,629	11,768	375	20	355	3,715	1,355	2,360	9,682	2,981	6,701
Radio and TV receiving equipment	365	93	0	93	(D)	0	(D)	(D)	0	(D)	(S)	0	(S)
Communication equipment	366	8,742	3,408	5,334	(D)	(D)	(D)	(D)	(D)	(D)	6,621	2,690	3,931
Electronic components	367	(D)	(D)	4,747	(D)	(D)	62	(D)	(D)	1,428	(D)	(D)	1,981
Other electrical equipment	361-64,369	(D)	(D)	1,594	46	0	46	254	0	254	(D)	(D)	760
Transportation equipment	37	35,900	20,908	14,992	572	374	198	(D)	(D)	1,713	(D)	(D)	9,379
Motor vehicles and motor vehicles equipment	371	(D)	(D)	8,550	(D)	0	(D)	(D)	(D)	439	(D)	(D)	(D)
Other transportation equipment	373-75,379	(D)	(D)	302	(D)	0	(D)	(S)	0	(S)	107	(D)	(D)
Aircraft and missiles	372,376	25,357	19,217	6,140	496	374	122	2,650	1,425	1,225	16,454	12,406	4,048

See explanatory information and SOURCE at end of table.

Table B-6. Funds distributed for basic research, applied research, and development, by industry and size of company, by source of funds: 1990

[Dollars in millions]

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Distribution by industry	SIC code	Total			Basic			Applied			Development		
		Total	Federal	Company	Total	Federal	Company	Total	Federal	Company	Total	Federal	Company
Professional and scientific instruments	38	$6,163	$99	$6,064	(D)	(D)	$211	$688	$19	$669	(D)	(D)	$2,223
Scientific and mechanical measuring instruments	381-82	2,086	10	2,076	(D)	(D)	25	(D)	(D)	111	(D)	(D)	441
Optical, surgical, photographic, and other instruments	383-87	4,077	89	3,988	(D)	(D)	186	(D)	(D)	558	(D)	(D)	1,782
Other manufacturing industries	27,31,39	(D)	(D)	445	50	0	50	(D)	(D)	81	(D)	(D)	278
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	9,258	2,743	6,515	892	535	357	1,902	687	1,215	5,245	1,105	4,140
Distribution by size of company [Based on number of employees]													
Less than 500		(S)	990	(S)	392	119	273	(S)	(S)	(S)	(S)	(S)	(S)
500 to 999		1,956	(S)	1,817	108	0	108	293	(S)	292	1,020	57	963
1,000 to 4,999		7,378	840	6,538	506	(D)	(D)	1,605	(D)	(D)	4,212	401	3,811
5,000 to 9,999		6,145	278	5,867	153	0	153	1,219	73	1,146	3,205	149	3,056
10,000 to 24,999		11,771	1,549	10,222	525	(D)	(D)	3,390	(D)	(D)	4,993	846	4,147
25,000 or more		68,921	26,784	42,137	1,678	688	990	9,941	2,946	6,995	40,474	16,321	24,153

Distribution by industry	SIC code	Not Distributed			Percent of Total Not Distributed		
		Total	Federal	Company	Total	Federal	Company
Total		$24,253	$7,540	$16,713	23.2%	24.7%	22.7%
Food, kindred, and tobacco products	20,21	(D)	(D)	274	20.0%	100.0%	19.9%
Textiles and apparel	22,23	47	0	47	(D)	0.0%	20.7%
Lumber, wood products, and furniture	24,25	39	0	39	21.7%	0.0%	21.7%
Paper and allied products	26	213	0	213	28.9%	0.0%	28.9%
Chemicals and allied products	28	3,413	36	3,376	27.2%	53.7%	27.0%
Industrial chemicals	281-82,286	1,284	36	1,248	29.6%	56.3%	29.2%
Drugs and medicines	283	2,020	0	2,020	(D)	0.0%	35.7%
Other chemicals	284-85,287-89	108	0	108	(D)	0.0%	4.2%
Petroleum refining and extraction	13,29	558	12	546	26.6%	75.0%	26.2%
Rubber products	30	429	0	429	(D)	0.0%	58.6%
Stone, clay, and glass products	32	50	0	50	(D)	0.0%	5.6%
Primary metals	33	(D)	(D)	139	(D)	(D)	18.0%
Ferrous metals and products	331-32,3398-99	(D)	(D)	99	(D)	(D)	41.3%
Nonferrous metals and products	333-36	40	0	40	(D)	0.0%	7.5%

See explanatory information and SOURCE at end of table.

Table B-6. Funds distributed for basic research, applied research, and development, by industry and size of company, by source of funds: 1990

[Dollars in millions]

		Not Distributed			Percent of Total Not Distributed		
Distribution by industry	SIC code	Total	Federal	Company	Total	Federal	Company
Fabricated metal products	34	$260	$37	$223	32.2%	27.8%	33.0%
Machinery	35	1,619	97	1,522	11.0%	10.8%	11.0%
Office, computing, and accounting machines	357	1,115	0	1,115	(D)	0.0%	10.1%
Other machinery, except electrical	351-56,358-59	504	97	407	(D)	(D)	14.8%
Electrical equipment	36	3,625	1,273	2,352	20.8%	22.6%	20.0%
Radio and TV receiving equipment	365	57	0	57	61.3%	0.0%	61.3%
Communication equipment	366	1,569	885	684	17.9%	26.0%	12.8%
Electronic components	367	1,655	379	1,276	(D)	(D)	26.9%
Other electrical equipment	361-64,369	344	9	335	(D)	(D)	21.0%
Transportation equipment	37	9,362	5,660	3,702	26.1%	27.1%	24.7%
Motor vehicles and motor vehicles equipment	371	3,383	587	2,796	(D)	(D)	32.7%
Other transportation equipment	373-75,379	222	61	161	(D)	(D)	53.3%
Aircraft and missiles	372,376	5,757	5,012	745	22.7%	26.1%	12.1%
Professional and scientific instruments	38	2,968	7	2,961	48.2%	7.1%	48.8%
Scientific and mechanical measuring instruments	381-82	1,502	3	1,499	72.0%	30.0%	72.2%
Optical, surgical, photographic, and other instruments	383-87	1,466	4	1,462	36.0%	4.5%	36.7%
Other manufacturing industries	27,31,39	36	0	36	(D)	0.0%	8.1%
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	1,219	416	803	13.2%	15.2%	12.3%
Distribution by size of company [Based on number of employees]							
Less than 500		1,404	268	1,136	17.2%	27.1%	15.8%
500 to 999		535	81	454	27.4%	58.3%	25.0%
1,000 to 4,999		1,055	132	923	14.3%	15.7%	14.1%
5,000 to 9,999		1,568	56	1,512	25.5%	20.1%	25.8%
10,000 to 24,999		2,863	174	2,689	24.3%	11.2%	26.3%
25,000 or more		16,828	6,829	9,999	24.4%	25.5%	23.7%

(D) Data have been withheld to avoid disclosing operations of individual companies.
(S) Data have been withheld due to imputation of more than 50 percent.

NOTE: Character-of-work data in this table represent only that fraction of total R&D for which there was a reported basis for distribution--they DO NOT represent universe estimates. The "Not Distributed" column shows those funds for which there was no basis for distribution.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

The 1988, 1989, and 1990 estimates of basic research, applied research, and development provided in Section A of this report were calculated using the baseline estimation method presented in Report NSF 90-322. In the baseline estimation method, the "Not distributed" expenditure data are allocated, by industry group, to basic research, applied research, and development categories, using the percentage splits in the distributed category for that industry. The allocation is done at the lowest level of published industry detail only; higher levels are derived by aggregation.

Mandatory Versus Voluntary Reporting

Current survey reporting requirements divide survey items into two groups: mandatory and voluntary. Response to four data items on the questionnaire (total R&D expenditures, Federal R&D funds, net sales, and total employment) is mandatory, whereas response to the remaining items is voluntary. To determine if combining both mandatory and voluntary items on one questionnaire influences response rates, NSF conducted, during the 1990 survey cycle, a test of the effect of reporting on a completely voluntary basis.

For this test the 1990 sample was divided into two panels of approximately equal size. One panel, the mandatory panel, was asked to report as usual (four mandatory items and the remainder voluntary), and the other panel, the voluntary panel, was asked to report all items on a completely voluntary basis.

The result of the test was a decrease in the overall survey response rate to 80 percent from levels of 88 percent in 1989 and 89 percent in 1988. The response rates for the mandatory and voluntary panels were 89 percent and 69 percent, respectively. Detailed unit and item response rates are shown in Tables B-7 and B-8.

Comparability of Data Over a Period of Several Years

Several procedures are undertaken to revise data and maintain the reliability of the time series.

Two-Year Comparability

Before the survey forms are mailed each year, Census imprints the data reported by the respondent the previous year (or 2 years earlier for items asked only in odd-numbered years). Respondents are asked to adjust data for the previous year(s), if necessary, to make them comparable to data provided for the current year. Such adjustments are necessitated by any of several developments, e.g., changes in company structure such as mergers, acquisitions, or divestitures; changes in reporting concepts; and even correction of any errors that may have been made previously. Thus, there is comparability in the reporting of survey data over any 2-year period.

Table B-7. Response rates, by industry, by survey panel: 1990

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	SIC code	Annual survey panel: Number of companies surveyed	Annual survey panel: Response rate	Mandatory survey panel: Number of companies surveyed	Mandatory survey panel: Response rate	Voluntary survey panel: Number of companies surveyed	Voluntary survey panel: Response rate
Total		1,696	79.4 %	959	88.5 %	737	67.4 %
Distribution by industry	[2]						
Food, kindred, and tobacco products	20,21	64	71.9	34	85.3	30	56.7
Textiles and apparel	22,23	42	76.2	21	85.7	21	66.7
Lumber, wood products, and furniture	24,25	40	62.5	19	84.2	21	42.9
Paper and allied products	26	39	79.5	22	86.4	17	70.6
Chemicals and allied products	28	146	85.6	89	89.9	57	78.9
Industrial chemicals	281-82,286	47	87.2	31	87.1	16	87.5
Drugs and medicines	283	36	88.9	24	95.8	12	75.0
Other chemicals	284-85,287-89	63	82.5	34	88.2	29	75.9
Petroleum refining and extraction	13,29	27	92.6	18	88.9	9	100.0
Rubber products	30	40	75.0	20	80.0	20	70.0
Stone, clay, and glass products	32	28	89.3	17	100.0	11	54.5
Primary metals	33	51	80.4	25	88.0	26	73.1
Ferrous metals and products	331-32,3398-99	23	78.3	11	72.7	12	83.3
Nonferrous metals and products	333-36	28	82.1	14	100.0	14	64.3
Fabricated metal products	34	64	76.6	33	90.9	31	61.3
Machinery	35	284	75.4	162	90.1	122	59.8
Office, computing, and accounting machines	357	99	65.7	56	87.5	43	37.2
Other machinery, except electrical	351-56,358-59	185	80.5	106	91.5	79	72.2
Electrical equipment	36	268	81.3	150	90.7	118	69.5
Radio and TV receiving equipment	365	5	100.0	3	100.0	2	100.0
Communication equipment	366	66	78.8	39	87.2	27	66.7
Electronic components	367	99	80.8	56	91.1	43	67.4
Other electrical equipment	361-64,369	98	82.7	52	92.3	46	71.7
Transportation equipment	37	121	83.5	93	95.7	28	42.9
Motor vehicles and motor vehicles equipment	371	37	64.9	22	90.9	15	26.7
Other transportation equipment	373-75,379	13	92.3	9	88.9	4	100.0
Aircraft and missiles	372,376	71	91.5	62	98.4	9	44.4

See explanatory information and SOURCE at end of table.

Table B-7. Response rates, by industry, by survey panel: 1990

Distribution by industry	SIC code	Annual survey panel		Mandatory survey panel		Voluntary survey panel	
		Number of companies surveyed	Response rate	Number of companies surveyed	Response rate	Number of companies surveyed	Response rate
Professional and scientific instruments	38	142	77.5 %	74	82.4 %	68	72.1 %
Scientific and mechanical measuring instruments	381-82	74	77.0	38	81.6	36	72.2
Optical, surgical, photographic, and other instruments	383-87	68	77.9	36	83.3	32	71.9
Other manufacturing industries	27,31,39	41	75.6	20	85.0	21	66.7
Nonmanufacturing industries	10-11,14-17,40-42,44-51,53-54,56,60,62-63,72-73,78,806-07,87	299	74.9	162	84.6	137	63.5

NOTE: The effect of the survey's mandatory reporting requirement on survey response rates was tested during the 1990 survey cycle. The annual panel was divided into two sub-panels for this test. One panel, the "Mandatory survey panel," received the standard survey questionnaire and the other, the "Voluntary survey panel," was asked to report on a completely voluntary basis.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

Table B-8. Response rates, by item, by survey panel: 1990

Page 1 of 1

Data Item	Annual survey panel	Mandatory survey panel	Voluntary survey panel
Sales 1/	75.6 %	84.5 %	64.1 %
Total Employment 1/	75.4	84.5	63.5
R&D Scientists and Engineers	58.9	61.6	55.4
Federal R&D 1/	68.2	76.1	57.8
Company R&D	69.9	77.3	60.3
Total R&D 1/	75.3	84.8	63.0
Energy R&D	44.3	46.4	41.6
Pollution abatement R&D	45.9	47.7	43.5
Foreign R&D	57.1	59.7	53.6

1/ Mandatory data item

NOTE: The effect of the survey's mandatory reporting requirement on survey response rates was tested during the 1990 survey cycle. The annual panel was divided into two sub-panels for this test. One panel, the "Mandatory survey panel," received the standard survey questionnaire and the other, the "Voluntary survey panel," was asked to report on a completely voluntary basis.

SOURCE: National Science Foundation/SRS, Research and Development in Industry: 1990

These adjustments can be examined by comparing data for the same year reported in two succeeding periods, e.g., 1989 data appearing in the 1989 edition of Research and Development in Industry may differ from 1989 data in this volume. Totals for broad classifications are likely to be very close in the two editions; differences may be more noticeable in the finer detail. These differences underscore the point that the measures are approximate and indicative, rather than precise.

Historical Data Revisions

The published industry R&D survey data are revised periodically, usually because of changes in the SIC code classifications of companies. In addition, two other major data revisions were made in the data for the 1981-87 periods.

Companies may shift from one SIC code into another because of (1) the growth and/or decline of product lines; (2) the merger of two or more companies; (3) the acquisition of one company by another; (4) divestiture; or (5) the formation of conglomerates. When Census staff are aware of the year in which changes (2), (3), (4), or (5) occurred, [respondents are asked on the questionnaire about changes in ownership], they reclassify that firm's data into the new industry for the year the change actually occurred. If a change is not discovered until the new sample is selected or if it cannot be determined when a shift actually occurred, [i.e., (1)], other methodologies are used to adjust, or backcast, the data to reflect the move of a company out of one industry and into another. Since 1967, three revisions were made in the data, covering the periods 1967-76, 1976-81, and 1981-87.

1. The 1967-76 Period

The SIC codes assigned to companies in the panel for the years 1967 through 1975 were based on data reported in the 1967 economic census. The 1974 Standard Statistical Establishment List file was used to assign SIC codes to companies in the next panel chosen for the 1976 survey. These codes were used to revise 1975 data received in the 1976 survey. The SIC codes of companies in the 1967 and 1976 panels were examined to determine which companies had changed classifications. Since it was not known in which year changes actually occurred, data of companies that had changed SIC codes were revised for the years 1968 through 1974, to smooth the changes over the period 1967-76. To illustrate, if a company was originally in SIC A in 1967 but was discovered to be in SIC B in 1974, its data for 1967-74 were allocated between the two industries as follows: 1967--all of the company's data were retained in industry A; 1968--14.3 percent of the company's data were allocated to industry B, and the remainder retained in industry A; 1969--28.6 percent were allocated to industry B, and the remainder retained in industry A; and so on until 1974, when all of the company's data were allocated to industry B.

2. The 1976-81 Period

Backcasting revisions in the industry R&D data for 1976-80 were also made to reflect the classification changes revealed in the new sample drawn in 1981; however, a different methodology was used for the revisions.

When the new panel was selected in 1981, companies were assigned SIC codes from the 1981 SSEL and the 1981 Enterprise Files. Prior-period (1980) data were collected in the 1981 survey. These data were presumed to be more accurate than those collected in the 1980 survey, because they reflected not only updated SIC code classifications but were obtained from a larger panel, providing better coverage of U.S. industry. Data obtained for 1976-80, using the panel selected in 1976, were revised subject to the following constraints:

a. Data for 1976, revised from the 1977 survey, would remain unchanged, since this was the first year the 1976 panel and since that panel was an accurate reflection of company SIC codes in 1976.

b. Data for 1980 collected in the 1981 survey would be used instead of the 1980 data collected in the 1980 survey.

An algorithm was used to link data from 1976 with those collected in 1981, preserving, to the greatest extent possible, year-to-year trends in data for each industry, by revising data for the years 1977, 1978, and 1979.

The following data elements were adjusted, using the methodologies just described: Funds spent on R&D (total, Federal, company and other, and R&D performed outside the U.S.); number of full-time equivalent (FTE) R&D scientists and engineers; total and company and other R&D funds as a percent of net sales; and cost per R&D scientist or engineer. No adjustments were made in other data elements.

3. The 1981-86 Period

Similar backcasting revisions in the industry R&D data were made in 1987 for the industry data previously reported for the years 1981-86. Several other adjustments were made in 1987 in addition to the original methodology described for the revisions made in 1981.

When the 1987 sample was selected, companies were assigned SIC codes from the 1987 SSEL File. Companies in the sample were asked to submit their prior-year (1986) data along with the information collected for the 1987 survey. These new 1986 data were used in lieu of the data originally collected in the 1986 survey because they reflected updated SIC code classifications of companies and also were collected from a much larger sample that was designed to provide better coverage of U.S. industry, particularly the nonmanufacturing portion. Data obtained for 1981-86 using the panel selected in 1981 were revised in 1987, subject to the following constraints:

a. Data for 1981, revised from the 1982 survey, would remain unchanged, since this was the first year the 1981 panel was used, and since that panel was an accurate reflection of company SIC codes in that year.

b. Data for 1986 collected in the 1987 survey would be used instead of the 1986 data collected in the 1986 survey.

There was an increase of $9,265 million between the 1986 data based on the old panel and the 1986 data reported by the new panel identified in 1987. Most of that aggregate revision was caused by the addition of new R&D performing firms identified through the revised sampling procedures in 1987. An algorithm was used to link data from 1981 with those collected in 1987, to the greatest extent possible preserving year-to-year trends that had previously been reported in data for each industry by revising data for the years 1982, 1983, 1984, and 1985. Interested persons should contact Census to obtain further information about the construction and content of the algorithm.

4. Federal Data for 1986

Data for a merger between two companies were incorrectly processed in the 1988 tabulations, resulting in an overcount of Federal R&D support for industry in the amount of $356 million in 1986. The corrected 1986 industry R&D total (company, Federal, and other funds) is $87,823 million, and the Federal total is $27,891 million. These corrections are reflected in Tables A-1, A-3, and A-13 of this report. No revisions to published 1988 individual industry data were necessary, because data for the affected industry were suppressed to avoid possible disclosure of information about operations of individual companies (i.e., these data cells are marked with the symbol "D").

5. Data Reevaluations for 1987

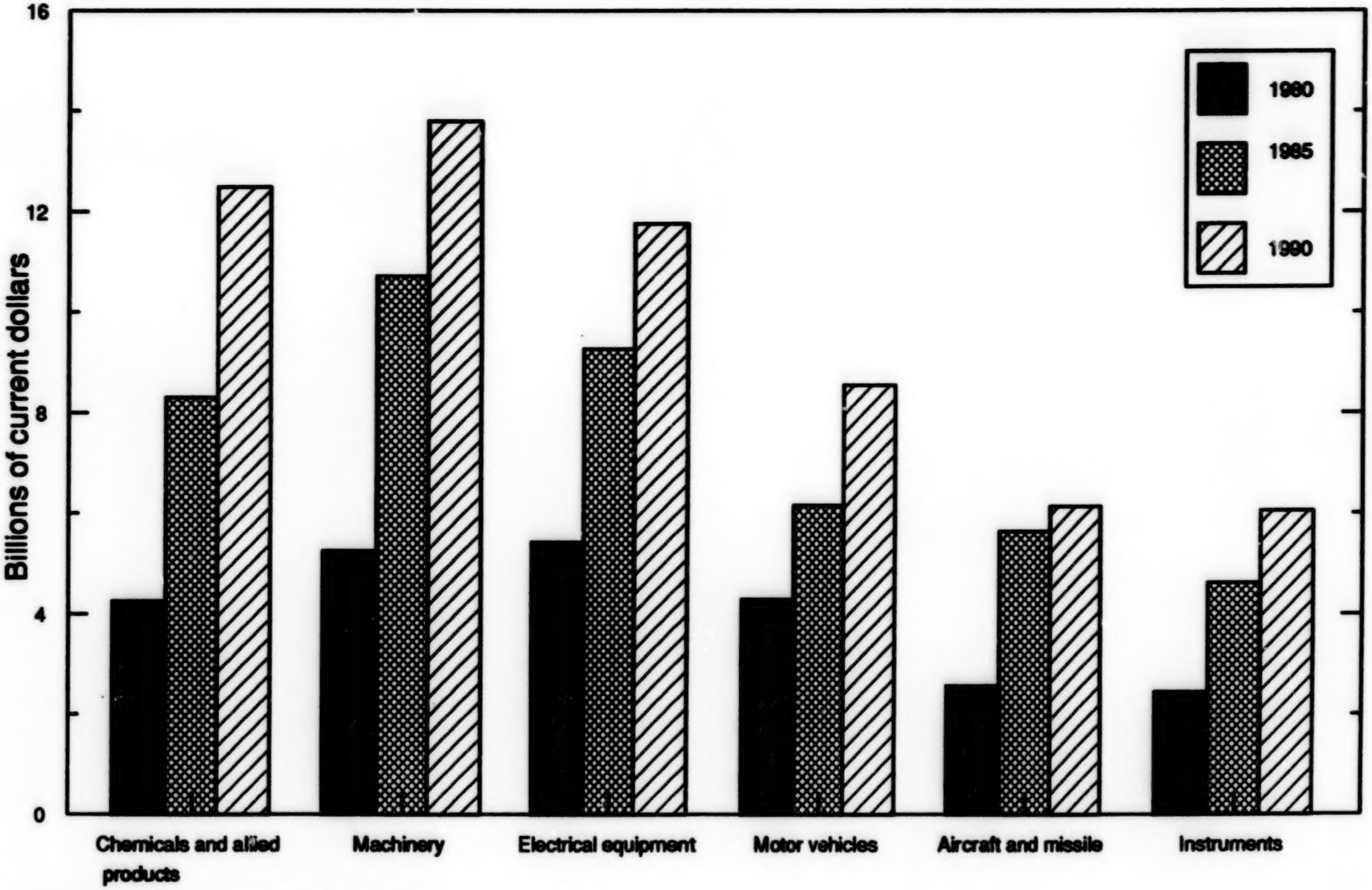
Many of the small firms identified in the 1987 sample were receiving this kind of form for the first time, and some were not accustomed to reporting financial information rounded to the nearest thousand dollars. Several of these firms, therefore, mistakenly reported their expenditures for R&D in dollars, not thousands of dollars as requested. Consequently, several firms were selected for the 1987 panel based on an incorrectly reported size of their R&D program. Many of these firms realized their error when they received the 1988 form with the preprinted 1987 data. The respondents corrected their 1987 data when they submitted the 1988 forms.

Furthermore, several of these firms reported, in 1988, that they had no R&D program, even though they had previously reported expenditures for R&D activities in the 1987 survey. Following verification of no R&D activity by telephone, Census staff declared these firms to be out-of-scope and blanked the erroneous information from the 1987 estimates during processing of the survey results in 1988.

Similar reporting errors were encountered during the 1989 data collection and processing. In addition, review of the 1989 estimates revealed an error in the revision procedure used for firms discovered to be out-of-scope in 1988. This error resulted in only a partial correction for these firms during the 1988 processing. These errors caused Census to take the unusual step of revising the 1987 R&D expenditure estimates in 1989. (Revisions to data two-years back is rarely done, except during sample years when historical adjustments are made to account for shifts in industrial classification.)

Based on all the adjustments listed above, Chart 2 depicts trends in company R&D expenditures for individual industries.

Chart 2. Company and other (except Federal) funds for R&D performance by selected industry



SOURCE: National Science Foundation, SRS

Survey Definitions[5]

Research and development: Basic and applied research in the sciences and engineering and the design and development of prototypes and processes. (This definition excludes quality control, routine product testing, market research, sales promotion, sales service, other nontechnological activities or routine technical services, and research in the social sciences or psychology.)

> **Basic research:** Original investigations for the advancement of scientific knowledge not having specific immediate commercial objectives, although such investigations may be in fields of present or potential interest to the reporting company.
>
> **Applied research:** Investigations for the discovery of new scientific knowledge having specific commercial objectives with respect to products or processes. (This definition differs from that of basic research chiefly in terms of the objectives of the reporting company.)
>
> **Development:** Technical activities of a nonroutine nature concerned with translating research findings or other scientific knowledge into products or processes. (Not included are routine technical services to customers or other activities excluded from the foregoing definition of R&D.)

See next subsection, **Explanation of Tabular Data,** for a discussion of the format in which these data are being published.

Full-time-equivalent (FTE): The number of scientists and engineers in the company who are assigned full time to R&D projects together with the fraction of total work time spent on R&D projects by non-full-time R&D scientists and engineers.

Funds for R&D: Operating expenses incurred by a company in the conduct of R&D in its own laboratories or other company-owned or -operated facilities. (These expenses include wages and salaries, materials and supplies consumed, property and other taxes, maintenance and repairs, depreciation, and an appropriate share of overhead, but exclude capital expenditures. Except where indicated, all funds for R&D performance are expressed in current, rather than constant, dollars.)

Company (and other) funds for R&D: Cost of R&D actually performed within the company, and funded by the company itself or by other non-Federal sources via contract. [These data therefore do not include the cost of R&D supported by companies but contracted to outside organizations, such as research institutions, universities and colleges, nonprofit organizations, or (to avoid double-counting) other companies. Since it is a survey of R&D performers, industrial firms that undertake R&D supported by outside organizations do report the funds received in payment for the R&D work they perform. These monies are classified under the industries of the performing companies.]

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[5] See Section D for more detailed definitions contained in the instruction booklet sent to survey respondents.

Federal funds for R&D: Represents receipts for R&D performed by the company on Federal R&D contracts or subcontracts and R&D portions of procurement contracts and subcontracts.

Federally funded research and development centers (FFRDCs): R&D-performing organizations administered by industrial, educational, or other institutions on a nonprofit basis, exclusively or substantially financed by the Federal Government (FFRDCs are supported by the Federal Government either to meet a particular R&D objective or, in some instances, to provide major facilities at universities for research and associated training purposes. R&D expenditures of the FFRDCs that are industry-administered are included with the Federal R&D data of the industry classification of each of the administering firms.)

R&D scientists and engineers: The January number of those engaged full time in R&D and the full-time equivalent of those working part time in R&D. (Scientists and engineers are defined as persons engaged in scientific or engineering work at a level that requires knowledge of physical, life, engineering, or mathematical science, equivalent, at least, to that acquired through completion of a 4-year college program with a major in one of those fields.)

Employment: Total number of persons domestically employed by R&D-performing companies in all activities during the pay period that includes the 12th of March. (These data are not completely comparable with the data on R&D scientists and engineers described in the foregoing paragraph, because the earlier data are collected for January of each year.)

Net sales and receipts: Recorded dollar values for goods sold, or services rendered, by R&D-performing companies to customers (outside the company), including the Federal Government, less such items as returns, allowances, freight, charges, and excise taxes. (Domestic intracompany transfers and sales by foreign subsidiaries are excluded, but transfers to foreign subsidiaries and export sales to foreign companies are included.)

Geographic area covered: Includes only those operations located in the 50 States and the District of Columbia.[6]

Explanation of Tabular Data

Classification of reporting units: The basic reporting unit is the company or corporate family that includes all establishments under common ownership or control. All R&D expenditures and all scientists and engineers of each company are classified into a single SIC code and size category.[7]

Industry classification: Census staff assigned an enterprise-level SIC code to each company. A single SIC code was assigned to multi-establishment companies based on the code which represented the most dominant aggregated activity for that firm (in terms of total payroll).[8] Data for the following industry groupings [with SIC code(s)[9] shown in parentheses] are published in this report:

- Food and tobacco (20,21)[10]
- Textiles and apparel (22,23)
- Lumber, wood products, and furniture (24,25)
- Paper and allied products (26)
- Chemicals and allied products (28)
  - Industrial chemicals (281-82,286)
  - Drugs and medicines (283)
  - Other chemicals (284-85,287-89)
- Petroleum refining and extraction (13,29)
- Rubber products (30)

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[6] Company-sponsored R&D performed outside the United States by foreign subsidiaries of U.S. domestic companies is reported in Table A-9, but excluded from all other tables.

[7] An exception was made for most of the companies classified in SIC code 13 (oil and gas extraction) and SIC code 50 (wholesale trade, durable goods). Because the R&D activity of these companies is in manufacturing product areas rather than service areas, their R&D expenditures were included with the SIC classifications of the manufacturing codes which encompassed the highest dollar value of their payroll. The R&D expenditures of all such firms in SIC 13 were included with those of the firms in SIC 29 (petroleum). The R&D expenditures of these types of firms in SIC 50 were allocated to several manufacturing SIC codes.

[8] See footnote #7.

[9] When the sample was drawn in 1987, the 1972 SIC code numbers were in effect.

[10] Until 1984, the tobacco products industry (SIC 21) was included with "other manufacturing industries."

- Stone, clay, and glass products (32)
- Primary metals (33)
  - Ferrous metals and products (331-32,3398-99)
  - Nonferrous metals and products (333-36)
- Fabricated metal products (34)
- Machinery (35)
  - Office, computing, and accounting machines (357)
  - Other machinery, except electrical (351-56,358-59)
- Electrical equipment (36)
  - Radio and TV receiving equipment (365)
  - Communication equipment (366)
  - Electronic components (367)
  - Other electrical equipment (361-64,369)
- Transportation equipment (37)
  - Motor vehicles and motor vehicles equipment (371)
  - Other transportation equipment (373-75,379)
  - Aircraft and missiles (372,376)[11]
- Professional and scientific instruments (38)
  - Scientific and mechanical measuring instruments (381-82)
  - Optical, surgical, photographic, and other instruments (383-87)
- Other manufacturing industries--printing and publishing (27), leather products (31), and miscellaneous manufacturing industries (39)[12]
- Nonmanufacturing industries--mining (10-11,14); construction (15-17); transportation, communications, electric, gas, and sanitary services (40-42,44-49); wholesale and retail trade (50-51,53-54,56); finance, insurance, and real estate (60,62-63); personal and business services (72-73); motion pictures (78); health services (806-07); and engineering, accounting, research, management, and related services (87)

Company size-class: Companies are categorized by their total number of domestic employees. The following are the six company size-classes used in this report: fewer than 500 employees; 500 to 999 employees; 1,000 to 4,999 employees; 5,000 to 9,999 employees; 10,000 to 24,999 employees; and 25,000 or more employees.

Cost per R&D scientist or engineer: The number of FTE R&D scientists and engineers used to estimate the cost per R&D

---

[11] Because of the close similarity of their R&D activities, companies primarily engaged in the manufacture of ordnance and accessories, including complete guided missiles, are grouped with companies primarily engaged in the manufacture of aircraft and parts,

[12] See footnote #10.

scientist or engineer for 1980-90 is the arithmetic mean of the numbers of FTE R&D scientists and engineers reported for January in two consecutive years. This number is then divided into the total R&D expenditures of the earlier year, and the ratio is attributed to the earlier year. For example, the mean of the numbers of FTE R&D scientists and engineers in January 1990 and January 1991 is divided into total 1990 R&D expenditures for a total cost per R&D scientist or engineer in 1990.

Method of computation: Because of rounding, detailed statistics in tables may not add to totals or subtotals. Also, percentages were calculated on the basis of thousands of dollars and may differ from those based on rounded figures shown.

Nonavailability of statistics: Census staff conduct the survey under Title 13 of the U.S. Code which prohibits publication or release of data that may reveal information about individual companies. Therefore, some of the Detailed Statistical Tables, Section A, contain one or both of the following footnotes:

- "(D)," which is used to indicate data are being withheld to avoid possible disclosure of information about operations of individual companies. (This occurs when a small number of companies, usually one or two, account for a large percentage of the R&D funds or of scientists and engineers in a particular data cell. The tables most often affected by this rule are those that contain data on Federal support to companies for R&D performance.)
- "(S)," which is used to indicate that the imputation rate--the percentage of the statistic not reported by respondents and consequently estimated by Census staff--exceeds 50 percent for that item. (Users should consult Table B-3 for imputation rates for specific items.)

Although publication of data may be withheld from certain cells, these data are always included in totals. In some instances, data withheld because of high imputation rates [footnote reference "(S)"] can be derived by subtraction from higher-level totals. In such cases, the user should be aware that the derived numbers are statistically unreliable. In no instance can data be derived that would disclose operations of individual companies [footnote "(D)"].

Section C. Industry-Administered Federally Funded Research and Development Centers

Supported by the Department of Energy:

Bettis Atomic Power Laboratory
Westinghouse Electric Corporation
West Mifflin, PA

Energy Technology Engineering Center
Rockwell International Corporation
Canoga Park, CA

Hanford Engineering Development Laboratory
Westinghouse-Hanford Corporation
Richland, WA

Idaho National Engineering Laboratory
EG&G Idaho, Inc.;
Argonne National Laboratory, West;
Rockwell International Corporation;
Westinghouse Electric Corporation
Idaho Falls, IA

Knolls Atomic Power Laboratory
General Electric Company
Schenectady, NY

Oak Ridge National Laboratory
Martin Marietta Energy Systems, Inc.
Oak Ridge, TN

Sandia National Laboratories
Western Electric Company, Inc.--Sandia Corporation
Albuquerque, NM

Savannah River Laboratory
Westinghouse Electric Corporation
Aiken, SC

Supported by the National Institutes of Health, Department of Health and Human Services:

Frederick Cancer Research Facility
Program Resources, Inc.
Frederick, MD

Section D. Survey Documents

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NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

OFFICE OF THE
DIRECTOR

FROM THE ACTING DIRECTOR
NATIONAL SCIENCE FOUNDATION

The majority of research and development performed in the United States occurs in the industrial sector. Consequently, leaders in business and government need timely and accurate information about industrial R&D. The National Science Foundation's annual Survey of Industrial Research and Development is the only source of such information on a national basis.

Your company's participation in this survey is vital to the accuracy of the resulting information. Because R&D expenditures are concentrated in relatively few companies, a completed response is needed from each surveyed firm — there is no good substitute for the information that you can provide.

Your company can be assured of complete confidentiality. Survey data will be released only in aggregate form so that responses of individual companies cannot be identified.

Survey results will be made available to government and industry officials, researchers, and other interested individuals. If you would like to receive a copy of the final publication or if you have suggestions for improvements, please contact Mr. John Gawalt, Division of Science Resources Studies, Room L-602, National Science Foundation, Washington, DC 20550, or telephone at (202) 634-4648.

Sincerely,

Frederick M. Bernthal

Enclosure

RD-1-L2 (2-7-81)

RD-1-L1
(2-14-91)

UNITED STATES DEPARTMENT OF COMMERCE
Bureau of the Census
Washington, D.C. 20233

OFFICE OF THE DIRECTOR

FROM THE DIRECTOR
BUREAU OF THE CENSUS

The Bureau of the Census conducts the "Survey of Industrial Research and Development" under sponsorship of the National Science Foundation. These measures of research and development expenditures by industry are important in analyzing and forecasting long-term economic growth, investigating determinants of productivity, formulating tax policy recommendations, and comparing individual research performance against industry averages.

We are enclosing your report form and a file copy for the "Survey of Industrial Research and Development," Report RD-1. To reduce response burden, we alternate between "long" and "short" versions of this reporting form. We are using the "short" version this year to obtain information for calendar year 1990.

We are also enclosing an instruction manual. Please read it carefully, since it provides guidelines for reporting. You may want to refer to it as you complete your report. We recognize that you may not maintain book records for particular items. In such cases, please use carefully prepared estimates.

The law (Title 13, United States Code) authorizes this report. Items 1A and 1B and Columns 2 and 4 of Item 4C are part of the basic statistical program of the Bureau of the Census for manufacturing companies, and reporting of these items is mandatory. Response to the remainder of the inquiries is voluntary; however, we need your cooperation to make the results of the survey comprehensive and accurate. By Section 9 of the same law (Title 13), your report to the Census Bureau is fully confidential. Only sworn Census Bureau employees will see the information you reported, and they will use it only for statistical purposes. The law also provides that copies retained in your files are immune from legal process.

Please return the completed form within 60 days. If you have questions concerning this survey, please direct them to the Special Surveys Branch of our Industry Division on (301) 763-5598. If you need additional copies of the report or additional time, please call (812) 288-3331. We appreciate your past cooperation in this important survey and look forward to your continued participation.

Sincerely,

Barbara Everitt Bryant

Barbara Everitt Bryant

Enclosures

RD-1(V)-L1
(2-91)

UNITED STATES DEPARTMENT OF COMMERCE
Bureau of the Census
Washington, D.C. 20233

OFFICE OF THE DIRECTOR

FROM THE DIRECTOR
BUREAU OF THE CENSUS

The Bureau of the Census conducts the "Survey of Industrial Research and Development" under sponsorship of the National Science Foundation. These measures of research and development expenditures by industry are important in analyzing and forecasting long-term economic growth, investigating determinants of productivity, formulating tax policy recommendations, and comparing individual research performance against industry averages.

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Reporting in this survey is voluntary; however, we need your cooperation to make the results of the survey comprehensive and accurate. The law (Title 13, United States Code) authorizes this report. By Section 9 of the same law (Title 13), your report to the Census Bureau is fully confidential. Only sworn Census Bureau employees will see the information you reported, and they will use it only for statistical purposes. The law also provides that copies retained in your files are immune from legal process.

We ask that you return the completed form within 60 days. If you have questions concerning this survey, need copies of the form, or need additonal time, please call the Special Surveys Branch of our Industry Division on (301) 763–5598. We appreciate your past cooperation in this important survey and look forward to your continued participation.

Sincerely,

Barbara Everitt Bryant

Barbara Everitt Bryant

Enclosures

FORM **RD-1 (I)**
(11-27-90)

U.S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS

COLLECTING AND COMPILING AGENT FOR
THE NATIONAL SCIENCE FOUNDATION
WASHINGTON, DC 20233

INSTRUCTIONS FOR SURVEY OF INDUSTRIAL RESEARCH AND DEVELOPMENT DURING 1990

Outline of instructions

Section — **Page**

General instructions 2
Important notes 2

Section I — GENERAL COMPANY DATA 2
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Definition of Research and Development 2

Section II — RESEARCH AND DEVELOPMENT PERFORMED WITHIN THE COMPANY IN THE UNITED STATES 2
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Item 5 — Research and Development by Functional Category 5
Item 6 — Total Company Funds Spent for Research and Development Activities Performed by Foreign Subsidiaries Outside the United States 5
Item 7 — Status of This Company on December 31, 1990 5

Public reporting burden for this collection of information is estimated to range from 2 to 30 hours, averaging 5 and one-half hours per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information including suggestions for reducing this burden to Herman G. Fleming, National Science Foundation, 1800 G Street, Washington, DC 20550; and to the Office of Management and Budget (OMB No. 3145-0027), Washington, DC 20503.

GENERAL INSTRUCTIONS

Comprehensive and timely information about the nature and support of corporate research and development activities is an important component in the overall assessment of our nation's scientific and technological resources. The information you provide is used to prepare national measures of industrial research and development not available from any other source. By carefully completing this report, the accuracy of this information is ensured.

Report for Your Entire Company — Research and development activities for your entire domestic company should be reported, including all subsidiaries, divisions, etc. Report sales and employment figures for all parts of the company, even those that do not perform R&D, as long as they are located in the 50 states or the District of Columbia.

Companies Reporting in Survey for the First Time — Companies which did not report in the 1989 survey are asked to provide figures for both 1989 and 1990. If the company had no R&D expenditures, complete only item 1. Enter "No R&D" in the "Remarks" section, sign, and return the form.

Period Covered by the Report — Figures should be reported on a calendar year basis. Fiscal year data, however, are acceptable for all items except for employment, provided your fiscal year ends between September and March. Please report employment figures (items 1B and 3) for the specific time indicated for both of these items.

Revision of Earlier Year Figures — If your company reported for 1989, entries from that form are preprinted on the current form. Please revise the 1989 figures to be comparable with 1990 data and explain in the "Remarks" section any significant revisions made.

Year-to-year changes — Please describe in the "Remarks" section the reasons for any substantial differences in the 1990 figures when compared to corresponding 1989 figures.

Estimates Are Acceptable — If you cannot answer a question from your company records, please estimate the answer carefully. Direct any questions regarding this form to the Bureau of the Census, ATTN: Industry Division, Washington, DC 20233-0001, or call (301) 763—5598.

Additional Forms — Photocopies of this form are acceptable. If you require additional forms, write to the Bureau of the Census, 1201 East 10th Street, Jeffersonville, IN 47132-0001 or call (812) 288-3331.

IMPORTANT NOTES

- **Financial information** — Report all financial information in thousands of dollars.
- **Employment information** — Report all employment information in numbers of people.
- **Sales and Employment (item 1)** — Report sales and employment information from all domestic subsidiaries, including those that do not perform research and development.
- **Costs incurred for R&D (item 4)** — Include R&D depreciation and overhead in your estimated costs. Exclude R&D capital expenditures.
- **Costs incurred for R&D (item 4)** — Costs incurred for R&D performed outside the 50 states or the District of Columbia or for R&D contracted out to non-company R&D organizations should not be reported in this item (item 4). R&D performed outside of the United States should be reported in item 6. R&D contracted out to non-company R&D organizations is outside the scope of this report.

▶ Section I — GENERAL COMPANY DATA

▶ Item 1 — Sales and Employment for Company

▶ **Item 1A — Net Sales** — Report net sales and receipts for this company and its subsidiaries. The reported figures should represent value f.o.b. plant after discounts and exclude freight charges and excise taxes.

Include:

- sales of products and services to other companies, individuals, U.S. Government agencies, and foreign countries
- transfers to foreign subsidiaries

Exclude:

- domestic intra-company transfers
- sales by foreign subsidiaries

▶ **Item 1B — Employment** — Report the number of employees of the company in all activities in the 50 states and the District of Columbia during the pay periods which include March 12 of 1989 and 1990. This figure would be the same as Item 1 of Treasury Form 941, if one Form 941 was filed for the entire company.

▶ Section II — RESEARCH AND DEVELOPMENT PERFORMED WITHIN THE COMPANY IN THE UNITED STATES

▶ Item 2 — Research and Development Expenditures

Definition of Research and Development — Research and development includes basic research and applied research in the sciences and in engineering, and design and development of prototype products and processes. For the purposes of this study, research and development includes activities carried on by persons trained, either formally or by experience, in the physical sciences including related engineering, and the biological sciences including medicine, if the purpose of such activity is to do one or more of the following things:

1. Pursue a planned search for new knowledge, whether or not the search has reference to a specific application.
2. Apply existing knowledge to problems involved in the creation of a new product or process, including work required to evaluate possible uses.
3. Apply existing knowledge to problems involved in the improvement of a present product or process.

Research and development includes the activities described above whether assigned to separate R&D organizational units of the company or carried out by company laboratories and technical groups not part of an R&D organization. Reporting the R&D activities of such latter groups may require the use of estimates for some of the questions.

Activities to be excluded from R&D —

- capital expenditures
- routine product testing
- research in social sciences or psychology
- geological and geophysical exploration activities
- technical services such as:
    - quality and quantity control
    - technical plant sanitation control
    - trouble-shooting in connection with breakdowns in full-scale production
    - advertising programs to promote or demonstrate new products or processes
    - assistance in preparation of speeches and publications for persons not engaged in research and development

► **Item 3 — Research and Development Scientists and Engineers** — Scientists and engineers are defined for this survey as all persons engaged in scientific or engineering work at a level which requires a knowledge of physical or life sciences, engineering, or mathematics equivalent to completion of a 4-year college course with a major in these fields, regardless of whether or not they actually hold a degree in this field.

The figure on R&D scientists and engineers will be obtained primarily from two sources:

1. For company laboratories performing only research and development, report the number of scientists and engineers on the rolls in January.
2. For companies whose activities are not solely devoted to research and development, report the proportion of total work time of scientists and engineers that is devoted to research and development. For example, if a company had 60 scientists and engineers in January 1990 and one-fourth of their time was charged to R&D projects, the figure for the number of R&D scientists and engineers for this company would be 15.

► **Item 4 — Costs Incurred For Research and Development Performed Within the Company by Major Type and Source of Funds —**

Include:

- wages, salaries, and related costs
- materials and supplies consumed
- R&D depreciation and overhead
- costs of computer software used in R&D activities
- total charges for work done on contract, including profit
- utilities, such as telephone, telex, electricity, water, and gas
- travel costs and professional dues
- property taxes and other taxes (except income taxes) incurred on account of the R&D organization or the facilities they use
- insurance expense
- maintenance and repair, including maintenance of buildings and grounds
- company overhead including: personnel, accounting, procurement and inventory, and salaries of research executives not on the payroll of the R&D organization

Exclude:

- R&D performed abroad (See item 6), such as Canada and Puerto Rico
- cost of R&D performed by non-company R&D organizations of any kind
- capital expenditures
- patent expense
- income taxes and interest
- the portion of company-held R&D contracts that were subcontracted outside the reporting company
- fellowships, grants, and gifts to promote R&D or the study of science and engineering

Methods of Estimating Research and Development Expenditures by Type — (Basic, Applied, and Development) — If your company does not keep records that meet or can be allocated to these specific categories, estimate by:

1. Isolating the **projects** that clearly fall in the development category. If your company fabricates products, such development activity will include the design, construction, and testing of prototypes and models. Some defense contracts typically call for several test models. If your company's research and development frequently involves the development of a "process" as in chemicals and petroleum, such development activity would include operations beyond the bench scale, primarily the design and operations of pilot plants or semiworks.
2. Isolating the **organizational units** which have R&D activities that can be readily classified, based on the function assigned to the unit. If R&D work is done in production units as well as in various laboratories, it is generally development type.
3. Distributing the **balance** on the basis of a review of individual projects or on the basis of other summaries of the work. Please use the definitions for basic, applied, and development given below.

Types of Research

► **Item 4A — Basic Research** — Include the cost of research projects which represent original investigation for the advancement of scientific knowledge and which do not have specific immediate commercial objectives (although they may be in the fields of present or potential interest to the reporting company).

► **Item 4B1 — Applied Research** — Include the cost of research projects which represent investigation in discovery of new scientific knowledge and which have specific commercial objectives with respect to either products or processes.

► **Item 4B2 — Development** — Include the cost of projects which represent technical activity concerned with non-routine problems encountered in translating research findings or other general scientific knowledge into products or processes. Exclude routine technical services to customers or other items excluded from the definition of total research and development in item 2.

Types of Activity Included in Development —

- design and operation of pilot plants and semiworks plants
- engineering activity required to advance the design of a product or process so it meets specific functional and economic requirements
- design, construction, and testing of prototypes and models
- designs for special manufacturing equipment and tools
- preparation of reports, drawings, formulas, specifications standard practice instructions, or operating manuals

Types of Activity Excluded from Development —

- toolmaking and tool tryout
- production of detailed construction drawings and manufacturing blueprints
- pre-production planning

Source of Funds — Federal and Company

► **Item 4, Column 2 — Federal Funds —**

Include:

- cost of work done on Federal R&D contracts or subcontracts
- R&D portions of procurement contracts or subcontracts

Exclude:

- Federal R&D contracts and R&D portions of procurement contracts that you subcontracted to other R&D organizations (including these would cause duplication in the statistical totals, which include data on work actually performed by each company.)

► **Item 4, Column 3 — Company and Other Non-Federal Funds—**

Include:

- all company-sponsored research and development performed within the company
- R&D performed under contract from non-Federal sources

Exclude:

- company-sponsored research performed outside of the company

► **Item 4E — Company and Other Funds, Except Federal, Budgeted for the year 1991** — Report the estimated cost of company and other non-federally sponsored R&D that will be performed within the 50 states and the District of Columbia.

Item 5 — Research and Development by Functional Category

Item 5A to 5E — Energy Research and Development — Include all spending for research and development to increase energy resources or capabilities, including the development of energy equipment. Energy research and development can include costs of R&D projects (both product and process) on explorations, extractions, transportation, processing, storage, generation (including conversion), distribution, conservation, etc., of present, new, or improved forms of energy.

If R&D spending is for joint or multiple purposes, estimate and report the portion of cost incurred for the energy purpose. In the limited number of cases where the separation of joint (multiple) costs by type of energy cannot be estimated, include the total cost of the R&D project when the primary purpose of the project is energy research and development. If the project is not primarily for energy research and development then exclude all of the project cost.

Conservation and utilization includes R&D activities undertaken to reduce consumption either at the point of energy use or in the transmission, transportation, storage, or conversion of energy. Examples of such are research and development undertaken primarily to reduce fuel consumption in manufacturing, to improve the efficiency of transportation of energy products, or to produce an end product which is more efficient in energy consumption.

All other energy includes areas such as wind, waste, hydroelectric, etc. Also include in this category the development of energy equipment which cannot adequately be classified in items 5A to 5C.

Item 5F — Pollution Abatement Research and Development — Includes R&D spending for the purpose of reducing or eliminating the emission of pollutants. "Pollution" refers to the emission of pollutants to the outside of a firm's property or activities; "abatement" includes prevention, treatment, or recycling.

Exclude costs:

- to contribute to environmental aesthetics
- to increase equipment durability in corrosive environments
- to conserve energy (include as energy R&D in item 5C)
- to conserve natural resources
- to increase employee comfort, safety, and health

If the only purpose of the R&D spending is pollution abatement, include the total expenditures on the project. If pollution abatement is only one of several purposes, report only the R&D costs associated with pollution abatement. When the separation of joint costs is not feasible, include the total R&D costs for a project if the purpose is primarily (more than 50 percent) for pollution abatement.

If the project is not primarily for pollution abatement purposes, exclude all of the project costs. Also exclude project costs if expected pollution abatement benefits are obtained at no extra cost.

► **Item 6 — Total Company Funds Spent for Research and Development Activities Performed by Foreign Subsidiaries Outside the United States** — Report the amount of research and development financed by the U.S. parent or its foreign subsidiaries and performed by company R&D laboratories, branch plants, or other organizations, located outside the United States. Include R&D funds spent in Canada and Puerto Rico. This item excludes R&D activities performed by foreign subsidiaries which were financed by foreign governments or other outside organizations.

NOTE — Foreign subsidiaries are those outside the 50 states or the District of Columbia.

► **Item 7 — Status of This Company on December 31, 1990** — In the "Remarks" section, specify change or correction, e.g., "wholly-owned subsidiary of ABC Company", "merger with XYZ Company", "acquired by 123 Corporation". Provide date of organizational change.

PLEASE RETURN BY [illegible]

OMB No. 3145-0027: Approval Expires 09 30 9[illegible]

NOTICE — Your report to the Census Bureau is confidential by law (title 13, U.S. Code). It may be seen only by sworn Census employees and may be used only for statistical purposes. The law also provides that copies retained in your files are immune from legal process.

RETURN TO
Bureau of the Census
1201 East Tenth Street
Jeffersonville, IN 47132

Name of person who supplied 1989 data

Your participation is essential to make the results of this survey comprehensive, accurate, and timely. Response to items 1A and 1B and to item 4C, columns 2 and 4 for 1990 will satisfy the mandatory reporting requirements (title 13, U.S. Code).

CENSUS USE ONLY

SURVEY CODE 4001
INDUSTRY CODE
WEIGHT
STATE
ADDRESS
SIC CODE

FORM **RD-1**
(11 1 90)

U.S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS
ACTING AS COLLECTING AGENT FOR
THE NATIONAL SCIENCE FOUNDATION

SURVEY OF INDUSTRIAL RESEARCH AND DEVELOPMENT DURING 1990

In correspondence pertaining to this report refer to the CENSUS FILE NUMBER (11 digits)

PLEASE RETURN THIS COPY
(Please correct any error in name, address, and ZIP Code)

GENERAL INSTRUCTIONS

- Please complete this form and return within 60 days in the envelope provided. Retain the file copy for your records. THIS REPORT SHOULD COVER YOUR ENTIRE COMPANY, INCLUDING ALL SUBSIDIARIES, UNLESS OTHERWISE DESIGNATED AND EXPLAINED IN REMARKS.
- Enter 0 (zero) where appropriate rather than leaving a blank space.
- Reasonably accurate estimates are acceptable.
- Figures for 1989 are those reported by your company last year. THE 1989 FIGURES SHOULD BE REVISED, IF NECESSARY, TO BE COMPARABLE WITH 1990 DATA.
- Explain in "Remarks" on the reverse side any substantial increases or decreases in 1990 figures over 1989 (e.g., new government contracts, acquisitions, mergers, divestitures, etc.)

PLEASE READ ENCLOSED INSTRUCTION MANUAL BEFORE COMPLETING THIS FORM

SECTION I – GENERAL COMPANY DATA

Item 1 – DOMESTIC SALES, RECEIPTS, AND EMPLOYMENT FOR COMPANY	**1989**	**1990**
A. Domestic net sales and receipts of this company *(Thousands of dollars)*	101	102
B. Total domestic company employment in all activities during the pay period which includes the 12th of March 1989 and 1990	103	104

SECTION II – [illegible] WITHIN THE COMPANY IN THE UNITED STATES

Item 2 – RESEARCH AND DEVELOPMENT EXPENDITURES

Are research and development expenditures for entire domestic company, including subsidiaries, reported on this form? ☐ YES ☐ NO – *Please explain in remarks or on transmittal letter*

Item 3 – NUMBER OF SCIENTISTS AND ENGINEERS INVOLVED IN RESEARCH AND DEVELOPMENT ACTIVITIES Apportion on a full-time equivalent basis. *(See instruction manual)*	**January 1990**	**January 1991**
TOTAL →	113	114

Item 4 – COSTS INCURRED FOR RESEARCH AND DEVELOPMENT PERFORMED WITHIN THE COMPANY BY MAJOR TYPE AND SOURCE OF FUNDS

Include R&D depreciation and overhead; exclude R&D capital expenditures. *(See instruction manual)*

		Thousands of dollars			
		1989	**1990**		
		TOTAL research and development (1)	Federal funds (2)	Company and other funds, except Federal (3)	TOTAL (Sum of columns 2 and 3) (4)
A. Basic research *If "None," please mark (X)* ☐		201	202	203	204
B. Applied research and development	1. Applied research	211	212	213	214
	2. Development	221	222	223	224
	3. TOTAL *(Sum of lines 1 and 2)*	231	232	233	234
C. TOTALS *(Sum of A and B3)* →			242	243	244
D. 1989 TOTALS →			252	253	254
E. Company and other funds, except Federal, budgeted for the year 1991 →				263	

Item 5 – RESEARCH AND DEVELOPMENT BY FUNCTIONAL CATEGORY
Of the total reported in item 4C, columns 2 and 4, report the following functional categories.

ENERGY RESEARCH AND DEVELOPMENT Include the project cost or portion of project cost incurred for the purpose of increasing energy resources or capabilities. Include cost by type of energy.	*Thousands of dollars*					
	1989		**1990**		**1991**	
	Federal funds	Total funds	Federal funds	Total funds	Projected Federal funds	Projected total funds
A. Total nuclear	001	002	003	004	005	006
B. Total fossil fuels	015	016	017	018	019	020
C. Total geothermal, solar, conservation and utilization	063	064	065	066	067	068
D. All other energy	071	072	073	074	075	076
E. Total of A through D →	077	078	079	080	081	082

POLLUTION ABATEMENT RESEARCH AND DEVELOPMENT Include the project cost or portion of the project cost incurred for the purpose of designing pollution abatement products or product characteristics or of designing pollution abatement features into processes.	*Thousands of dollars*					
	1989		**1990**		**1991**	
	Federal funds	Total funds	Federal funds	Total funds	Projected Federal funds	Projected total funds
F. Total →	029	030	031	032	033	034

SECTION III – [illegible] DEVELOPMENT PERFORMED OUTSIDE THE DOMESTIC COMPANY [illegible]

Item 6 – TOTAL COMPANY FUNDS SPENT FOR RESEARCH AND DEVELOPMENT ACTIVITIES PERFORMED BY FOREIGN SUBSIDIARIES OR BY OTHER ORGANIZATIONS OUTSIDE THE UNITED STATES	*Thousands of dollars*	
	1989	**1990**
	972	973

CONTINUE ON REVERSE SIDE

Item 7 — STATUS OF THIS COMPANY ON DECEMBER 31, [illegible]

A. Was the company listed in the [illegible] company on December 31, [illegible]

☐ Yes — Complete Item 7B
☐ No — Skip to Item 8

B. New owner information

Name
005

Date acquired
006

Address (Number and street)
007

City
008

State
009

ZIP Code
010

REMARKS
981

Item 8 — CERTIFICATION — This report is substantially accurate and has been prepared in accordance with instructions.

Key	Name of person to contact regarding this report — *Print or type*	Mo.	Day	Year
982				

Key	Telephone: Area code	Telephone: Number	Telephone: Extension	Signature of authorized official
983				

FORM [illegible]

PLEASE RETURN BY ☐

OMB No. 3145-0027: Approval Expires [illegible]

NOTICE — Your report to the Census Bureau is confidential by law (title 13, U.S. Code). It may be seen only by sworn Census employees and may be used only for statistical purposes. The law also provides that copies retained in your files are immune from legal process.

FORM RD-1(V)

SURVEY OF INDUSTRIAL RESEARCH AND DEVELOPMENT DURING 1980

U.S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS
ACTING AS COLLECTING AND COMPILING AGENT FOR
THE NATIONAL SCIENCE FOUNDATION

RETURN TO
Bureau of the Census
1201 East Tenth Street
Jeffersonville, IN 47132-0001

CENSUS USE ONLY
SURVEY CODE 4001
INDUSTRY CODE
WEIGHT
STATE
ADDRESS
SIC CODE

In correspondence pertaining to this report refer to this CENSUS FILE NUMBER (11 digits) ▶

Name of person who supplied 1979 data

Reporting on this survey is voluntary. However, your cooperation on this survey is essential to make the results of this survey comprehensive, accurate, and timely.

YOUR FILE COPY
(Please correct any error in name, address, and ZIP Code)

GENERAL INSTRUCTIONS

- Please complete this form and return within 60 days in the envelope provided. Retain the file copy for your records. THIS REPORT SHOULD COVER YOUR ENTIRE COMPANY, INCLUDING ALL SUBSIDIARIES, UNLESS OTHERWISE DESIGNATED AND EXPLAINED IN REMARKS.
- Enter 0 (zero) where appropriate rather than leaving a blank space.
- Reasonably accurate estimates are acceptable.
- Figures for 1979 are those reported by your company last year. THE 1979 FIGURES SHOULD BE REVISED, IF NECESSARY, TO BE COMPARABLE WITH 1980 DATA.
- Explain in "Remarks" on the reverse side any substantial increases or decreases in 1980 figures over 1979 (e.g., new government contracts, acquisitions, mergers, divestitures, etc.)

PLEASE READ ENCLOSED INSTRUCTION MANUAL BEFORE COMPLETING THIS FORM

SECTION I – GENERAL COMPANY DATA

▶ **Item 1 — DOMESTIC SALES, RECEIPTS, AND EMPLOYMENT FOR COMPANY**	1979	1980
A. Domestic net sales and receipts of this company *(Thousands of dollars)*	101	102
B. Total domestic company employment in all activities during the pay period which includes the 12th of March 1979 and 1980	103	104

[illegible]

▶ **Item 2 — RESEARCH AND DEVELOPMENT EXPENDITURES**

Are research and development expenditures for entire domestic company, including subsidiaries, reported on this form? ☐ YES ☐ NO — *Please explain in remarks or on transmittal letter*

▶ **Item 3 — NUMBER OF SCIENTISTS AND ENGINEERS INVOLVED IN RESEARCH AND DEVELOPMENT ACTIVITIES** Apportion on a full-time equivalent basis. *(See instruction manual)*	January 1980	January 1981
TOTAL ⟶	113	114

▶ **Item 4 — COSTS INCURRED FOR RESEARCH AND DEVELOPMENT PERFORMED WITHIN THE COMPANY BY MAJOR TYPE AND SOURCE OF FUNDS**

Include R&D depreciation and overhead; exclude R&D capital expenditures. *(See instruction manual)*

		Thousands of dollars			
		1979	1980		
		TOTAL research and development (1)	Federal funds (2)	Company and other funds, except Federal (3)	TOTAL *(Sum of columns 2 and 3)* (4)
A. Basic research *If "None," please mark (X)* ☐		201	202	203	204
B. Applied research and development	1. Applied research	211	212	213	214
	2. Development	221	222	223	224
	3. TOTAL *(Sum of lines 1 and 2)*	231	232	233	234
C. TOTALS *(Sum of A and B3)* ⟶			242	243	244
D. 1979 TOTALS ⟶			252	253	254
E. Company and other funds, except Federal, budgeted for the year 1981 ⟶				263	

▶ **Item 5 — RESEARCH AND DEVELOPMENT BY FUNCTIONAL CATEGORY**

Of the total reported in item 4C, columns 2 and 4, report the following functional categories.

ENERGY RESEARCH AND DEVELOPMENT Include the project cost or portion of project cost incurred for the purpose of increasing energy resources or capabilities. Include cost by type of energy.	*Thousands of dollars*					
	1979		1980		1981	
	Federal funds	Total funds	Federal funds	Total funds	Projected Federal funds	Projected total funds
A. Total nuclear	001	002	003	004	005	006
B. Total fossil fuels	015	016	017	018	019	020
C. Total geothermal, solar, conservation and utilization	063	064	065	066	067	068
D. All other energy	071	072	073	074	075	076
E. Total of A through D ⟶	077	078	079	080	081	082

POLLUTION ABATEMENT RESEARCH AND DEVELOPMENT Include the project cost or portion of the project cost incurred for the purpose of designing pollution abatement products or product characteristics or of designing pollution abatement features into processes.	*Thousands of dollars*					
	1979		1980		1981	
	Federal funds	Total funds	Federal funds	Total funds	Projected Federal funds	Projected total funds
F. Total ⟶	029	030	031	032	033	034

SECTION III – RESEARCH AND DEVELOPMENT [illegible]

▶ **Item 6 — TOTAL COMPANY FUNDS SPENT FOR RESEARCH AND DEVELOPMENT ACTIVITIES PERFORMED BY FOREIGN SUBSIDIARIES OR BY OTHER ORGANIZATIONS OUTSIDE THE UNITED STATES**	*Thousands of dollars*	
	1979	1980
	072	073

CONTINUE ON REVERSE SIDE

Item 7 — STATUS OF THIS COMPANY ON DECEMBER 31, 1980

A. Was the company listed in the address label owned or controlled by another company on December 31, 1980?

☐ Yes — *Complete item 7B*
☐ No — *Skip to item 8*

B. New owner information

Name 005		Date acquired 006
Address (Number and street) 007		
City 008	State 009	ZIP Code 000

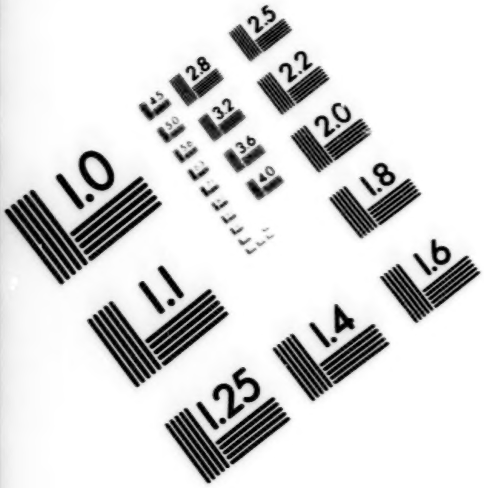
REMARKS
001

Item 8 — CERTIFICATION — This report is substantially accurate and has been prepared in accordance with instructions.

Key	Name of person to contact regarding this report — *Print or type*	Mo.	Day	Year
002				

	Telephone			Signature of authorized official
	Area code	Number	Extension	
003				

[illegible]



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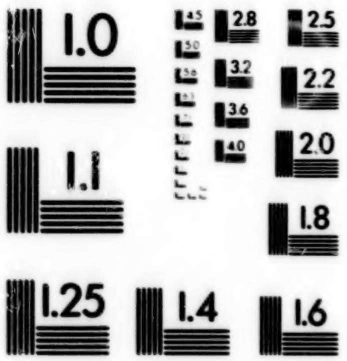

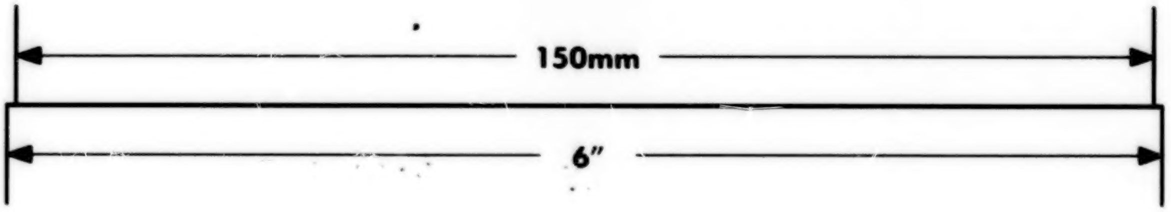

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